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THE TREATMENT OF RHEUMATIC CARDITIS WITH CORTISONE

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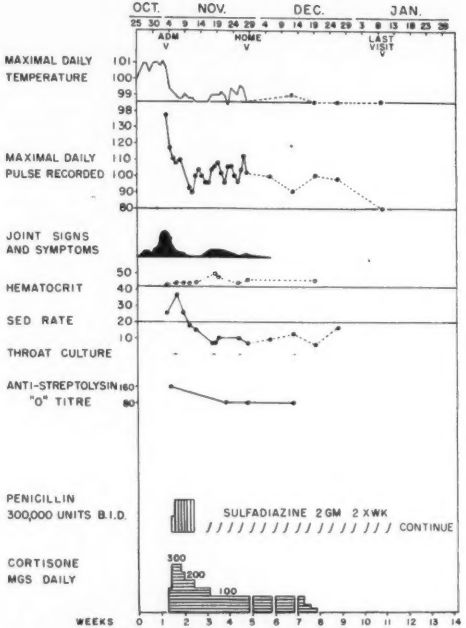
DURING the past few years, there have been several important advances in our knowledge of rheumatic fever. The most significant of these were: (1) the accumulation of data incriminating beta-hemolytic streptococci in the initiation of the train of events in rheumatic fever;[1-3] (2) the prevention of rheumatic fever by prompt penicillin therapy of hemolytic streptococcal respiratory infections;[1,3,4] (3) continuous penicillin prophylaxis in the rheumatic individual;[1,4,5] and (4) hormone suppression of the inflammatory process during the period of activity.[1,6-8]

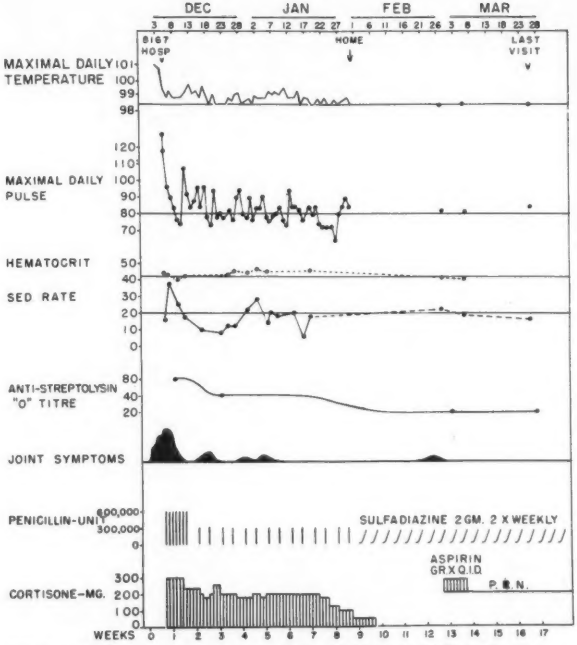
The controversy that has been carried on in the medical literature for over six years concerning the usefulness of hormone therapy in rheumatic fever is largely due to inadequate reporting of detailed clinical data, particularly regarding the severity of the symptoms, the duration of the disease prior to beginning treatment, the adequacy of the dosage, and the duration of treatment throughout the entire period of clinical evidence of activity. It is believed that with detailed tabulation of cases, readers have a better chance of evaluating the method of treatment and the results. This article evaluates the treatment of active rheumatic carditis by prolonged bed rest, chemotherapeutic drugs, and hormones. Thirty-eight cases are presented—12 in graphic form (figs. 1-15), 15 individually, and 11 in summary (table 1). Only 3 of the patients were children; the rest were adults—3 dependents, 2 WACs, and 30 soldiers.

From U. S. Army Hospital, Fort Jackson, S. C. Col. Gibson is now at P. O. Box 3025, San Roque Station, Santa Barbara, Calif.



WHITE FEMALE, AGE 33. HIST. NEG. FOR R.F. RECENT U.R.I. ACUTE MIGRATORY ARTHRITIS INVERTED T WAVES AND DEPRESSED S-T SEGMENTS ON ADM. TACHYCARDIA PERSISTED FOR 2MONTHS. NO MURMURS.

Figure 1 (case 1).

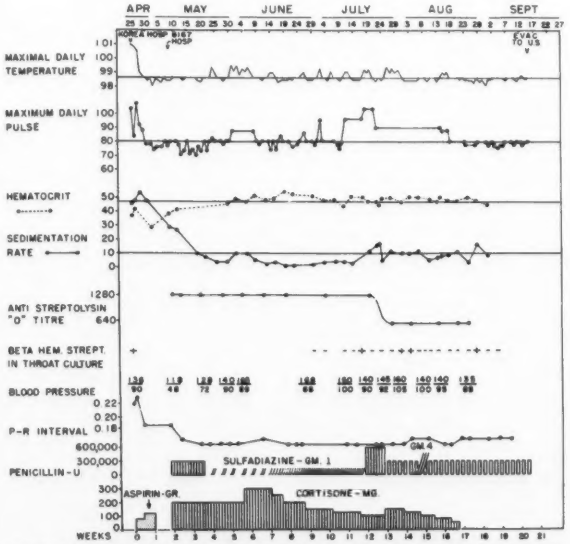


WHITE FEMALE AGE 26 NO HEART DAMAGE BEFORE OR ON DISCHARGE.

Figure 2 (case 2).

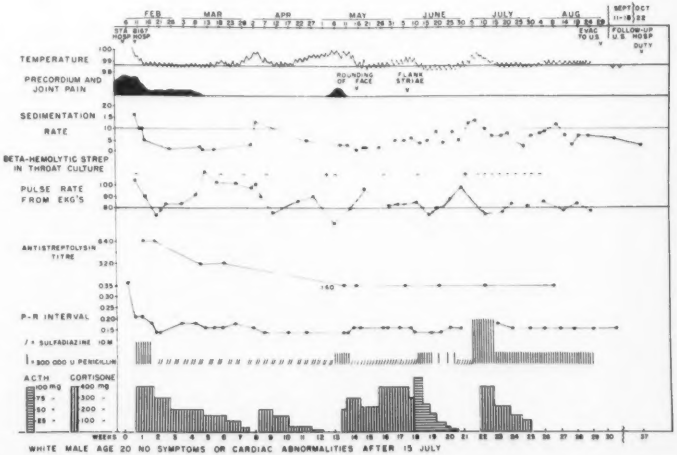
Figure 1 (case 1).

Figure 2 (case 2).



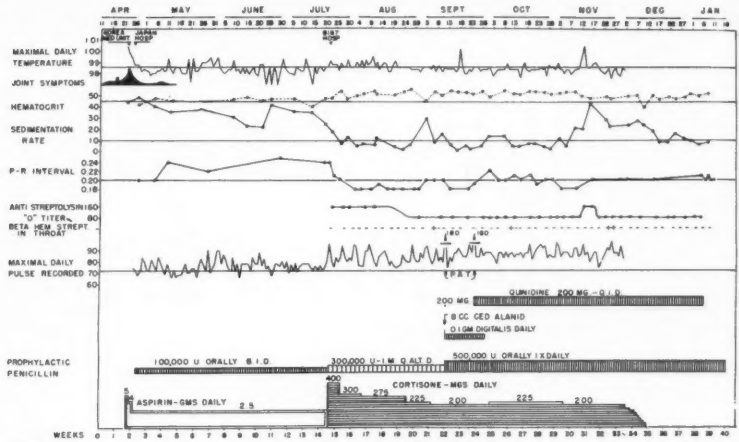
WHITE MALE, AGE 23, ATTACKS R.F. SINCE AGE 6. ACUTE JOINTS AND LOUD SYST. MUR. BASE AND APEX ON ADM. QUIETER ON DISCHARGE.

Figure 3 (case 3).



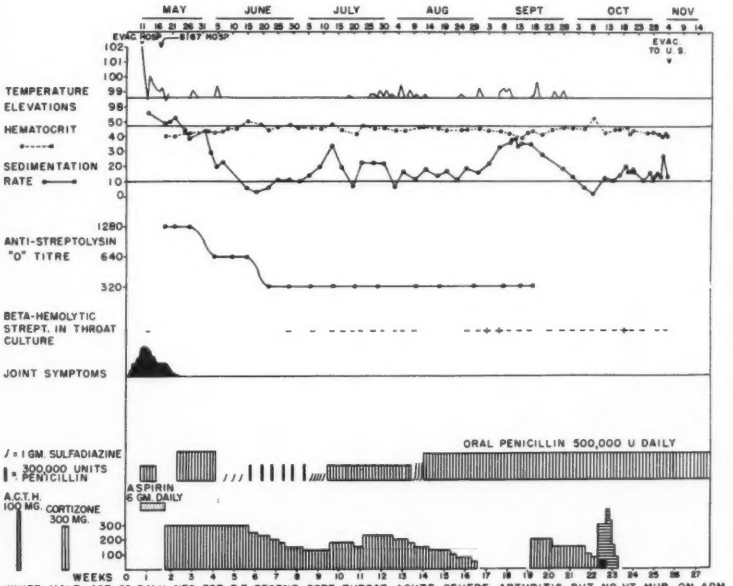
WHITE MALE AGE 20 NO SYMPTOMS OR CARDIAC ABNORMALITIES AFTER 15 JULY

Figure 4 (case 4).



WHITE MALE, AGE 23. R.F. AND R.H.D. EACH WINTER SINCE AGE 16. ACUTE SEVERE ARTHRITIS, A.I., AND M.I. ON ADM. EKG - LEFT STRAIN AND ELUOROSCOPY - L.V. ENL. - BOTH IMPROVED AFTER TREATMENT, NO CHANGE IN MURMURS

Figure 5 (case 5).



WHITE MALE, AGE 23 P.M.H. NEG. FOR R.F. RECENT SORE THROAT. ACUTE SEVERE ARTHRITIS, BUT NO HT. MUR. ON ADM. GR. 3 M.I. MUR. 10 DAYS LATER. QUIETER AFTER Rx GR. I AT TIME OF TRANSFER TO U.S.

Figure 6 (case 6).

Figure 7 (case 7). Note P-R prolongation and T-wave changes during early phase of active treatment.

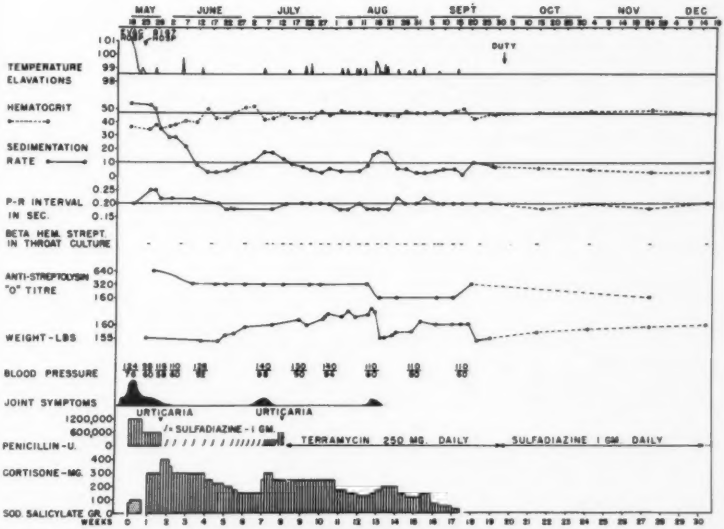
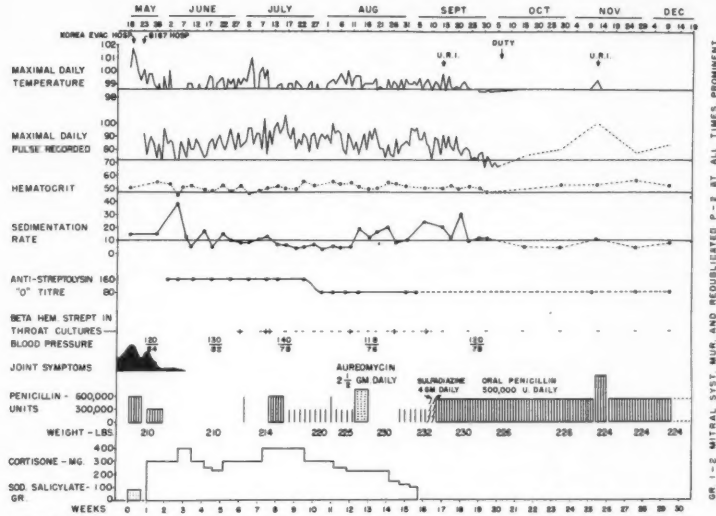
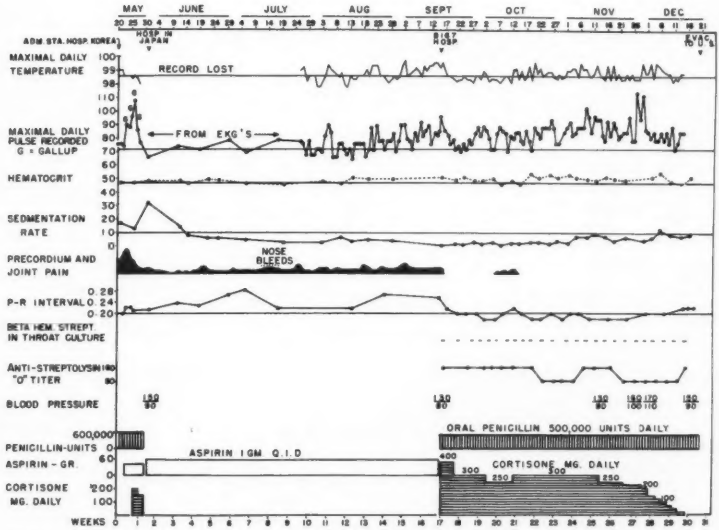


Figure 8 (case 7).



COLORED MALE, AGE 29 P. M. H. NEG. FOR R. F. IN HOSP. 15 MOS. 1946 - 47 - DIAGNOSED RHEUMATOID ARTHRITIS - NO RESIDUALS HOSP. 5 MOS. 1952. MILD ANKLE AND KNEE PAIN AFTERWARDS ON RAINY DAYS. ACUTE, SEVERE ARTHRITIS KNEES, ANKLES AND E. K. G. CHANGES ON ADM. NO PAIN AFTER 7 JUNE.

Figure 9 (case 8).



NEGRO MALE, AGE 25, R.H.D. SINCE CHILDHOOD, RECENT U.R.I. ACUTE MYOCARDITIS (FRICTION RUB AND GALLUP) AND ARTHRITIS ON ADM. HARSH GR. 2-3 M.I. MUR. AT ALL TIMES. APICAL DIASTOLIC PRESENT UNTIL MID. OCT. NOT HEARD LATER CARDITIS ACTIVE AFTER 7 MOS. IN HOSP. - 3 MOS. ON CORTISONE.

Figure 10 (case 9).

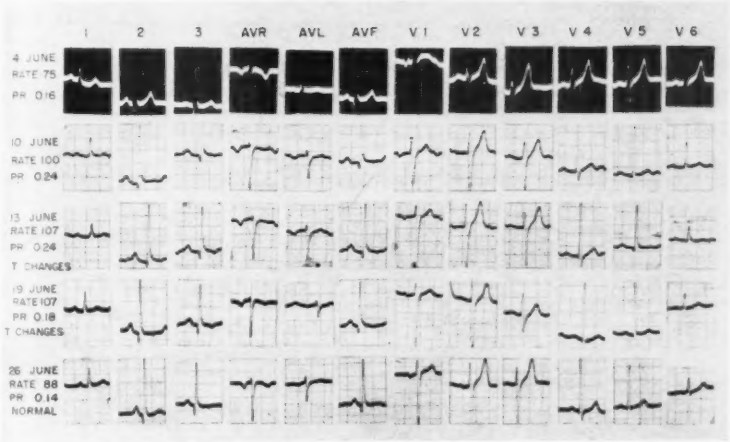
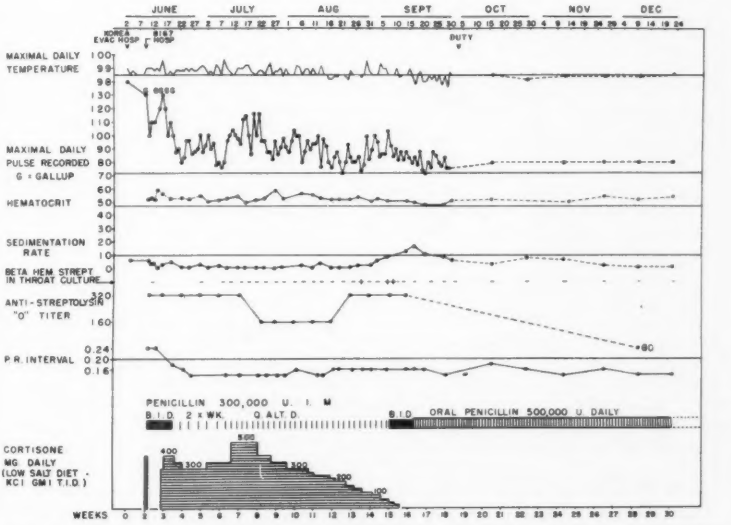
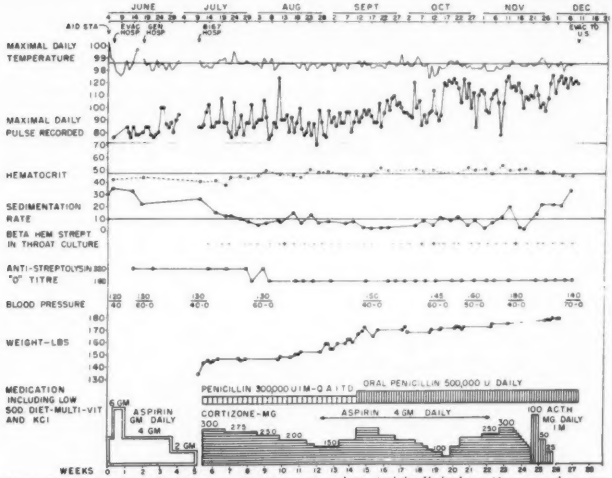


Figure 11 (case 10). Illustrating reversibility of prolonged P-R interval and T-wave abnormalities.



WHITE MALE AGE 24 R.F. 3 WKS. 1949. ON ADM: VERTIGO, DYSPNEA, TACHYCARDIA, MITRAL SYST. & PRESYST. MUR. NO ARTHRITIS. SYST. MUR. QUIETER, GR. 2 AND PRESYST. MUR. NOT HEARD AFTER 20 SEPT.

Figure 12 (case 10).



White male age 20 R. F. and R. H. D. age 13, 14, 15, 18, and 19. Activity limited age 13-murmur-shortness of breath since. Aching joints started in May. A. I. and A. S. severe on admission-same at time of evacuation to the zone of interior. Carditis still active. Activity continued through January 1954. Cushing-like features subsided during February 1954. Normal afterwards. Retired from military service 31 May 1954. Disability 60 per cent. A. I. severe either left venticle enlargemens and blood pressure, 155/40.

Figure 13 (case 11).

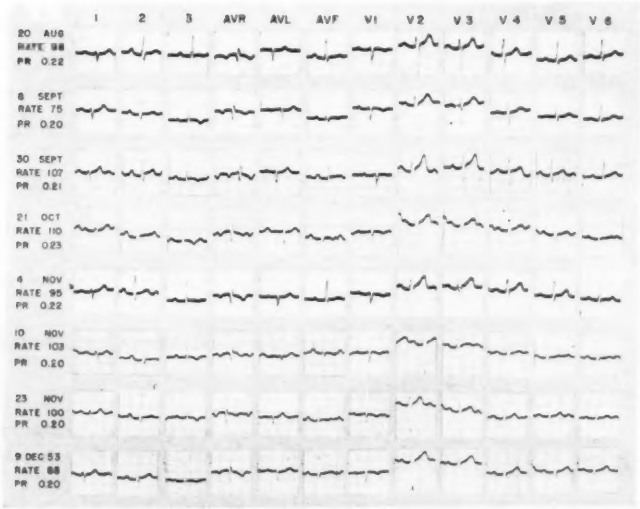
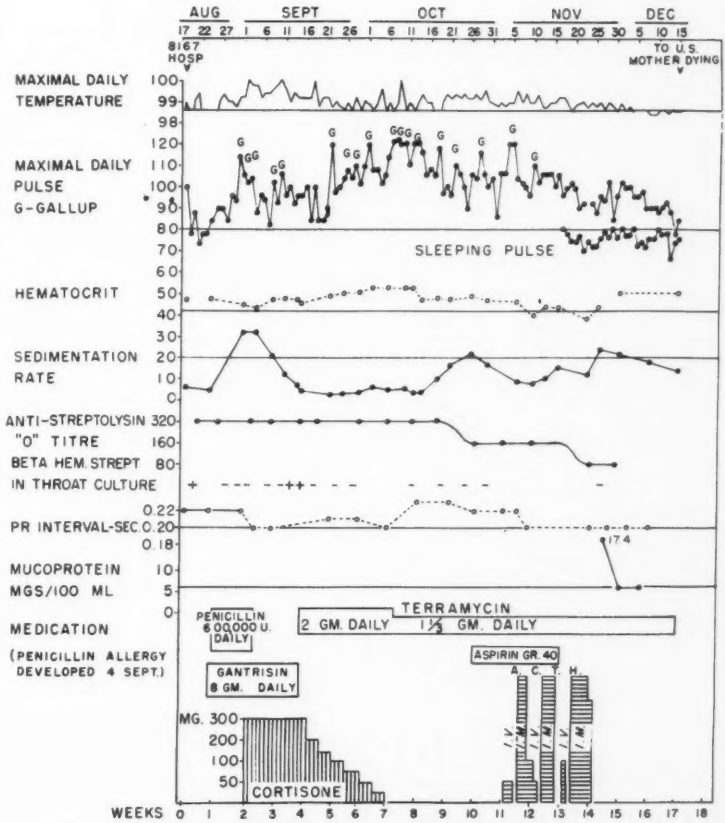


Figure 14 (case 12). Showing P-R interval fluctuating during treatment and possible effect of low serum potassium on T-waves.



White female age 21 hist. neg. for R. F. or U. R. I. only palpitation and dizziness on adm. no arthralgia, no murmur. Diagnosis doubtful until apical systolic murmur developed 10 days after admission. This was grade 1 on transfer. Heart size normal. Patient discharged to full duty 19 February 1954 after 6 months' hospitalization. Follow-up report of physical examination 21 October 1955: "grade II aortic systolic murmur, P-R interval 0.22 to 0.24 second. No heart enlargement by x-ray. Otherwise negative." Conclusion: Inadequate early treatment.

Figure 15 (case 12).

TABLE 1. *Summary of data on 26 cases of rheumatic carditis treated with cortisone*

History and physical			Clinical data					Cortisone therapy		Results (See also pp. 1419 and 1420)		
Case No. Adm. date Race, sex Age Weight	Past history	Condition on admission	Heart	Beta hemo-strep. cult. (wkly)	ECG (wkly)	Sed. rate Hematocrit C-reactive protein Antistrep. "O"	X-ray & fluor-oscopy	Weeks treat-ed	Mg (daily)	Clinical suppres-sion	Compli-cation	Activity after treat-ment
13 8-7-53 W, F 24 yr 116 lb	Severe chorea, age 15-16; recur. ages 21, 22, 23. Upper resp. inf. 21 days prior to adm.	Acute joint symp; dysp-nea; fatigue; T, 101°F; P, 120	Aortic insuff. & stenosis gr. IV; mi-tral insuff. gr. III; B. P., 140/40	Pos. on adm., neg. after-ward	Left vent. strain	Sed. rate, 39 Hemat., 39 Antistrep. "O", 640	L. vent. hyp.; slight Rt. vent. hyp.; cardio-thor. ratio, 13.5:26.5; 9 mo. later, 12.2:26.5	4 3 2 3 7	300 250 200 150 100	Good, ex-cept poor while on 100 mg	Hyper-cort. facies	Not sup-pressed during 6 mo. on aspirin or Butazolidin
14 8-10-53 W, M 24 yr 122 lb	"Flu" 2 days prior to adm.	Precordial pain, knees & ankles; T, 99.6°F; P, 110	Neg. on adm.; sys. murm. rate 126 on 16 Aug; gr. II mitral insuff. & chorea on 21 Aug.	Pos. 27 Aug.	Abnorm. T waves during treatm. P-R, 0.12-0.14	Sed. rate, 15 Hemat., 43 Muco-protein, 10.8 mg % Antistrep. "O", 80	Enlarged pulm. art. 22 Aug; norm. thereafter	3 1 11 1½ 2 2 8 1	None 300 400 None 300 400 300 ACTH	Fair; heart murm. & chorea de-creased during treatment	Asthma; hyper-tension (140/110) norm. after treatm.	None except for chorea
15 2-2-54 W, M 18 yr 170 lb	Rheum. F., age 11; frequent tonsillitis past 2 yr. Severe sore	Migratory arthritis Rt. shoulder, elbows, wrists, metacarpo-phalangeal	"Tic-tac"; rate 116; No murm.; 13 Feb. gr. I sys. apex;		Norm. P-R 0.20; 1 wk later & after-ward	Sed. rate, 47 Hemat., 43 Antistrep. "O", 500	Neg.	5½ 4 2 2 2 4	None 300 200 150 100 75	Good	Mild	None

170 lb	past 2 yr. Severe sore	metacarpo-phalangeal	gr. I sys. apex;		& after-ward			2 4	100 75			
	throat 3 wk prior to adm.; Rx with Aureomycin 1 wk	joints, ery-thema, mar-ginatum	15 Feb. gr. II sys. murm. apex & base		0.16			1 1	50 25			
16 3-20-54 W, F 9 yr 60 lb	Rheum. F., age 5; upper resp. inf. 2 days prior to adm.	Abdominal pain; loose stools, 2 days' duration; T, 102.6°F; P, 110	Neg.; gallop rhythm; mi-tral insuff. gr. I in 3 weeks		P-R, 0.14-0.15; after Rx, 0.12	Sed. rate, 43 Hemat., 35 C-reactive prot., neg. in 5th wk Antistrep. "O", 833	Neg.	3 1 4 15	None 200 150 100	Good	Hyper-cort. facies	None
17 4-4-54 W, M 19 yr 144 lb	Rheum. F., age 12; recur. of arthralgia pe-riodically since; last time 5 mo. prior to adm. Upper resp. inf. 2 wk prior to adm.	Acute arth-ritis, elbows, knees, then ankles 1 day; T, 102°F; P, 92	Gr. II sys. murm. base & Apex; 10 days later, diast. murm., apex	All neg.	Neg.	Sed. rate, 50 Hemat., 40 Antistrep. "O", 125; 2 wk later, 250	Neg.	1½ 9 3 4 4 6 3	None 200 150 to 75 200 300 250 to 100 75 to 25	Good on adequate dosage; 2 attempts at reducing dosage re-sulted in signs of activity	Hyper-cort. facies with acne	None; monthly exams. neg.; last seen 5-19-55, sed. rate 5; C-re-active prot., neg.; fluoroscopy & ECG neg.
18 4-16-54 W, M 28 yr 132 lb	Upper resp. inf. 14 days prior to adm.	Acute joint symp.; severe; T, 101°F; P, 110	Mitral in-sinuff. gr. III; tachy-cardia		P-R, 0.16-0.20; later, 0.14	Sed. rate, 44 Antistrep. "O", 250	Neg.	6 1 2	300 200 150	Good	Hyper-cort. facies; B. P., 160/90; acne	1 wk rebound
19 6-20-54 W, M 20 yr 140 lb	Upper resp. inf. 2 wk prior to adm.	Acute symp., knees, of 5 days' duration; T, 105°F; P, 120	Gallop rhythm; gr. I sys. murm., apex		P-R, 0.20; later, 0.16	Sed. rate, 51 Hemat., 36 Antistrep. "O", 250	Neg.	2 (da.) 2 4 1	None 300 200 100	Good	None	None

TABLE 1. *Summary of data on 26 cases of rheumatic carditis treated with cortisone.*—Continued

History and physical			Clinical data					Cortisone therapy		Results (See also pp. 1419 and 1420)		
Case No. Adm. date Race, sex Age Weight	Past History	Condition on admission	Heart	Beta hemo-strep. cult. (wkly)	ECG (wkly)	Sed. rate Hematocrit C-reactive protein Antistrep. "O"	X-ray & fluor-oscopy	weeks treat-ed	Mg (daily)	Clinical suppres-sion	Compli-cation	Activity after treat-ment
20 6-26-54 W, M 20 yr 146 lb	Upper resp. inf. 1 wk prior to adm.	Acute, severe arthritis, Rt. ankle, of 4 days' duration; T, 101°F; p, 92	Gr. I sys. murm., apex changing gr. II in 6 days		Normal P-R, 0.14	Sed. rate, 28 Hemat., 46 Antistrep. "O", 125; no titer 1 mo.	Neg.	6 (da.) 2½ 6	None 300 200	Good on 300 mg; slight activity 1st 3 wk on 200 mg	Mild hyper-cort. facies	None
21 7-1-54 N, M 19 yr 138 lb	Upper resp. inf. 6 wk prior to adm.	Acute symp., ankles & knees, 16 days' duration; T, 102°F; P, 84	Gr. II sys. murm., apex & base		P-R, 0.20; rate, 58; later P-R, 0.16	Sed. rate, 41 Hemat., 41 C-reactive prot., 1+ Antistrep. "O", 833	Neg.	2 3 1 1	None 300 200 150	Good	Acne	None; oral penicillin indefi-nitely
22 9-24-54 N, F 17 yr 138 lb	No history of Rheum. F. or upper resp. inf. prior to adm.	Abdominal & chest pains; dyspnea; nausea; T, 100°F; P, 106	Mitral in-suff. gr. II; basal, gr. III		Changing; non-specific	Sed. rate, 56 Hemat., 34 Antistrep. "O", 500	Neg.	2 7 2 7	None 300 150 225	Good, ex-cept while on 150 mg	Hyper-cort. facies	None
23 10-4-54 W, M 8 yr 60 lb	Upper resp. inf. 14 days prior to adm.	Abdominal pain; loose stools; sore throat; T, 102; P, 110	Neg.		L. vent. strain; P-R, 0.16	Sed. rate, 58 Hemat., 31 C-reactive prot., 3+ Antistrep. "O", 50	Neg.	2 4 2 4½ 1	None 100 75 50 25	Good; poor on 50 mg	Slight hyper-cort. facies	6 weeks low grade

24 1-5-55 N, M 18 yr 170 lb	No history of Rheum. F. or upper resp. inf. prior to adm.	Chest pain of 1 days' duration; T, 99.6°F; P, 100	Gr. II sys. murm. apex & base; 16 Jan, diast. murm., apex	Pos. on 27 Jan 3 Mar 3 May 5 Aug 29 Aug 12 Sept 12 Oct 31 Oct	Abnormal mostly T inversion V_3-V_6 from adm. through Sept; normal thereafter	Sed. rate, 41 Hemat., 35 C-reactive prot., neg. Antistrep. "O", 50	Normal 7 Jan 10 Jan 9 Mar 4 Apr 11 May 23 Aug	2 2 3½ 3 4 11 3 5 8	None 300 250 to none 300 250 to 150 300 400 500 400 to none	Poor on low dosage; good on massive doses	Hyper-con. facies with striae	
25 3-13-55 W, M 21 yr 170 lb (ht., 6')	Upper resp. inf. 1 mo. prior to adm.	Acute arthritis left ankle 1 wk, Rt. 1st metatarsal & Rt. knee 2 days; T, 101.2°F; P, 92	Gr. I sys. murm., base & left sternal border; gr. II 2 days later with gr. I sys. murm. at apex	Neg., except pos. 3-11 May, with fever	P-R, 0.20 & T in aVL down; after 2 wk, P-R, 0.16, & T in aVL up	Sed. rate, 55 Hemat., 34	Neg. Joints, neg.	7 1 1 1 1 1 1 1	300 250 200 150 100 75 50 25	Good. Sed. rate rose to 18 while on 200 mg; sed. rate, 12 & 13 on 150 mg	Mild hyper-cort. facies	None after discontinuing cortisone
26 3-20-55 W, M 18 yr 160 lb	Sore throat 2 wk prior to adm.	Acute, severe arthritis, Rt. foot 10 hr, next day left foot; tonsillitis; T, 101.6°F; P, 120-132	Tachycardia; gr. II sys. murm. left of sternum	Pos. 20 Mar 5 July 22 Aug	P-R, 0.20 sec on adm.; after 2-wk treatm. P-R, 0.14	Sed. rate, 52 Hemat., 38 C-reactive prot., 24 Antistrep. "O", 1,250	Neg. on adm.; not repeated	6 1 1 1 1 6 1 ½ 1	300 250 200 150 100 150 100 50 25	Good. Sed. rate rebound 10th wk. controlled on 150 mg; temporary rebound on 50 & 25 mg	None; on oral penicillin overseas; no follow-up	

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27 5-16-55 W, M 18 yr 128 lb (ht., 5'7")	Upper resp. inf. 1 mo. prior to adm.	Acute arth-ritis, both knees & Rt. ankle; patient acutely ill; T, 102°F; P, 110	Gr. II sys. murm., base & apex	Neg. on all ex-cept 1 tran-sient pos. 22 Aug.	Normal	Sed. rate, 51 Hemat., 38 C-reactive prot., 4+ Antistrep. "O", 166	Neg.	7 1 1 1 1 1 1	300 250 200 150 100 75 50 25	Good	Mild hyper-cort. facies; WBC rose to 19,000 during 1st 2 weeks of treatm.	Rebound sed. rate rise to 22 when cortisone reduced to 25 mg; nor-mal 1 wk later
28-38	History of Rheum. F. in 4, none in 7; upper resp. inf. prior to adm. in 8, none in 3	Acute joint sympt. in 11	Sys. murm. on adm. in 5 & during observation in 6	Pos. in 4; neg. in 7	Increased P-R in 6; normal in 5	Sed. rate elevated in 10 C-reactive prot., pos. in 10 Antistrep. "O", above 200 in 7	Neg. in 10; left vent. en-larged in 1	Average length of treatment 10 weeks		Good in all	Mild to moder-ate hyper-cort. facies in all	None in 10; slight rebound 10 days in 1 pt. age 9 yr

Additional Remarks, Final Examination, and Disposition

Case 13. This patient, a housewife, was admitted to the hospital four times (total hospitalization, 6 months), and also was treated as an outpatient. She received digitalis until 21 April 1954. Activity was not suppressed until August. Follow-up on 15 November 1954 showed grade II aortic insufficiency and stenosis, mitral insufficiency, and blood pressure of 140/20 mm Hg. These were compensated and asymptomatic.

Case 14. Throat cultures were positive 10-16 September, 4, 7, 24, 27 November, and 5 December, but negative thereafter. Carditis was active for 6 months. Chorea persisted until May 1954 (9 months). After May and at the time of the patient's discharge to duty, 14 July 1954, the clinical findings were negative except for a grade II apical systolic murmur. The patient's weight had increased from 122 to 138 pounds.

Case 15. This patient was treated with from 5.3 to 8 grams of salicylate daily for 5½ weeks with persistence of joint pains, heart murmurs, erythema marginatum, and lowest sedimentation rate 19 mm. All findings, except the heart murmurs, subsided on cortisone therapy. The apical murmur gradually became a faint grade I systolic. The basal murmur remained grade II. Hospitalization was prolonged for convalescence, considerable dental work, and a tonsillectomy. The patient was returned to duty with a P-3 profile on 6 January 1955.

Case 16. Electrocardiographic changes with wandering pacemaker and a systolic murmur were demonstrated during the first three weeks of aspirin therapy. After cortisone therapy, the electrocardiograms were normal, no murmur could be heard, and the patient's weight increased from 60 to 90 pounds. The child returned to school September 1954. On the last examination, 14 April 1955, clinical findings were negative, and the child weighed 88 pounds.

Case 17. This patient developed an apical diastolic murmur in 10 days while receiving 8 grams of aspirin daily, but the murmur was not heard on 1 May or thereafter. By late September, only a grade I systolic murmur was present at the base and apex. After rehabilitation the patient was discharged to duty, 7 January 1955, on prophylactic penicillin.

Case 18. This patient was discharged to duty 17 August 1954. At that time his heart size was normal, a grade I mitral insufficiency murmur could be heard after exercise, the P-R interval was 0.14 second, and the patient's weight had increased from 132 to 158 pounds.

Case 19. When this patient was returned to duty 30 August 1954, his heart was normal, the P-R interval was 0.16 second, he was asymptomatic, and his weight had increased from 140 to 164 pounds.

Case 20. The patient had a low-grade fever for 6 weeks. He was returned to duty, 3 November 1954, symptom-free except for a grade I systolic murmur. Physical examination findings, electrocardiograms, antistreptolysin "O" titer, C-reactive protein, sedimentation rate, and

fluoroscopic examination were negative on 14 March and 8 September 1955. No murmur was heard, and the patient's weight had increased from 146 to 155 pounds.

Case 21. The patient was returned to duty 8 September 1954. His heart was negative, no murmur could be heard, the P-R interval was 0.16, the rate was 74, and the patient was asymptomatic. On follow-up examination 7 January 1956 there had been no recurrence, no murmur could be heard, and the electrocardiographic, roentgenographic, and physical and laboratory examination findings were all within normal limits. The patient had gained 10 pounds in weight.

Case 22. This patient, a housewife, spent 4½ months in the hospital. Evidence of activity persisted until 15 January 1955. The murmurs were the same on 8 March 1955.

Case 23. Electrocardiographic findings in this patient were normal and the P-R interval was 0.12. No murmur could be heard on the last examination, 14 October 1955.

Case 24. The cortisone dosage for this patient was inadequate the first 4 months of his hospitalization. An apical systolic murmur became prominent and an apical diastolic murmur was heard intermittently through August 1955. Electrocardiographic findings were positive through September. The patient received cortisone therapy for 8½ months. Convalescence was uneventful through 45 days of physical reconditioning, and the patient was discharged to duty, 21 November 1955, with no restrictions. The last follow-up examination, 17 January 1956, showed recurrent slight stiffness in the right hip on strenuous exertion. The patient's pulse was 76; blood pressure, 120/70 mm Hg; and a grade I-II systolic murmur was heard at the apex and base, but no diastolic murmur was heard. The patient's weight had increased from 170 to 206 pounds.

Case 25. This patient probably had an intercurrent infection in May, for which he was adequately treated. No murmur was heard on repeated examinations after 20 May, and the electrocardiographic findings remained normal. The patient was asymptomatic and all findings were within normal limits at his discharge to full duty 17 October 1955.

Case 26. This patient was asymptomatic after the first week of hospitalization and the systolic murmur was no longer heard after mid-May. Convalescence and rehabilitation were uneventful and the patient was returned to full duty 21 October 1955 with all findings within normal limits. His weight had increased from 160 to 190 pounds.

Case 27. This patient's course in the hospital was uneventful throughout his treatment. Systolic murmurs persisted through September. No murmurs were heard after mid-October. He gained 10 pounds in weight. Examination was negative on his discharge to full duty 10 November 1955. Penicillin by mouth was continued.

I have used cortisone since 1951 to relieve symptoms and suppress the inflammation of rheumatic fever, and the patients treated in 1951 were reported previously.[6] The first 12 patients reported herein were treated in a U. S. Army hospital in Japan—2 in the fall of 1952 and 10 during 1953. Some were admitted directly to the hospital and some were transferred from Korean or other medical installations where they had been on salicylate therapy for varying periods of time. The last 25 patients were treated at this hospital during the period 1954-1956.

These patients were started on cortisone as soon after admission as the diagnosis was made. An antibiotic—penicillin, unless the patient was known to be allergic to it—was started at the same time, and in some cases prior to arriving at a definite diagnosis. In addition, each patient was placed on strict bed rest until the acute symptoms subsided, after which bathroom privileges were allowed. Hematocrit and sedimentation rate, antistreptolysin "O" titer, throat culture, and electrocardiographic studies of each patient were repeated twice weekly during the early stages of the illness and weekly thereafter. Heart fluoroscopy and roentgenograms were done early and one or more times later. Routinely, potassium chloride, 3 grams daily in divided doses, was administered orally. Serum potassium levels, which were determined frequently, remained in the normal range. Each patient was seen daily by the same physician. All patients were examined once or twice weekly by me, and were seen at various times by a consultant in cardiology. Temperature and pulse were checked by the ward nurse or ward master two to four times daily, and graphic charts were kept. The values shown in the graphs are the highest daily recordings. For the pulse rate, this admittedly is a poor method; nevertheless, it affords a fair figure for comparison, since the ward personnel taking the pulse rates were unaware of more than routine emphasis.

The initial dose of cortisone was 300 to 400 mg, depending on the weight of the patient. The oral route was preferred because of the ease of administration, the rapidity of absorption, and minimal discomfort to the patient. The daily dose was given initially at six-hour intervals and then at eight-hour intervals after the acute symptoms had subsided. For two patients weighing over 200 pounds, it was necessary to increase the dose to 500 mg daily before a remission in the various signs of disease activity could be obtained (cases 10 and 24).

The early concept was that suppression of positive signs of activity by the use of hormone therapy should be maintained throughout the active period of the disease. This was found to be practicable in all except two patients (cases 9 and 11) who were evacuated to the United States because of the termination

of their periods of service. Both had developed chronic corticoidism and both had prolonged periods of activity—seven and eight months at the time of evacuation. In general, the initial daily dose was continued until the patient was asymptomatic and the sedimentation rate, C-reactive protein, and electrocardiogram had returned to normal. This was usually from 7 to 10 days, but in some cases longer. As a rule, the temperature and pulse rate were near normal at this time, although from the graphs presented it will be noted that minor elevations in the temperature (usually in the afternoon or evening) and frequent elevations in the pulse rate at bed rest were recorded throughout the period of activity.

An attempt was then made to reduce the daily dose by 50 mg at four- to seven-day intervals to a daily dose of 200 to 300 mg, depending on the size and weight of the patient. Based on previous experience it was believed that approximately 1 mg of cortisone per pound of weight was the minimal dose that would maintain any appreciable suppression of disease activity. To obtain adequate suppression, approximately 1.5 mg of cortisone per pound of weight was the dosage goal for the first six to eight weeks of therapy. However, in cases 4, 6, 7, 8, 11, 14, 18, and 24, when fever, symptoms, elevated sedimentation rate, gallop rhythms, or prolongation of the P-R interval recurred, the dose was increased above this level. After six to eight weeks on relatively high doses of cortisone, and provided all findings indicated possible cessation of activity, the hormone was again decreased. This was accomplished by reducing the daily dose by 25 or 50 mg at three- or four-day intervals to zero or until signs of recurring activity were noted. In that event the dose was again increased until these signs reverted to normal, and then the increased dosage was continued for several weeks longer, after which the tapering off process was again attempted.

In general, the results of this plan of therapy have been most encouraging. The temptation to reduce the dosage of hormone prematurely is great, especially among medical officers using this method of treatment for the first time. This tendency must be constantly discouraged for best results. Case 4 is an example. This patient required repeated courses of cortisone, but after six months was successfully carried through his period of activity without demonstrable heart damage. It should be noted that cortisone was started early in the disease in this patient, when evidence of cardiac damage was limited to precordial pain and first-degree heart block. Cases 1, 2, 19, 20, 21, and 28-38 were treated promptly and the periods of activity were short. Case 16 was a nine-year-old child treated for five months with no residual cardiac damage evident after 13 months' follow-up. The other two children also recovered with no residuals after one year's follow-up in one and six months' follow-up in the other. Cases

9, 17, and 24 were treated for four, seven, and nine and a half months respectively, with recovery from apical diastolic murmurs that were heard frequently but later could not be heard by several internists and a consultant in cardiology. After prolonged treatment, a total of 23 patients (60.5 per cent) were left with no demonstrable heart damage, although carditis was evident in all before treatment.

Whether any of these patients would have sustained cardiac valvular damage had they been treated with salicylates can, of course, not be answered. In this series of patients, 33 of the 38 had significant murmurs. These disappeared in 19 patients (cases 9, 16, 17, 19-21, 24-27, and 28-36) or 57.8 per cent (table 2). The importance of early diagnosis and initiation of hormone therapy is borne out by the finding that murmurs disappeared in 78.6 per cent of those starting treatment within the first week of hospitalization, as compared with 42.1 per cent of those starting treatment in the second week or later. The P-R interval was prolonged in 11 patients; it returned to normal and remained normal in all but one (case 12). Due to difficulty in diagnosis and reluctance on the part of the ward officer to use adequate suppressive doses sufficiently long, this patient was inadequately treated.

TABLE 2. *Frequency of disappearance of murmurs at end of therapy*

Interval between admission to hospital and beginning of therapy (days)	Patients with significant murmurs	Disappearance of murmurs	
		Number	Per cent
1 to 7	14	11	78.6
8 to 14	10	4	40.0
14 and over	9	4	44.4
Total	33	19	

Undesirable effects of hormone therapy were not too pronounced in this series of patients. Occasionally, indigestion was treated with antacids. Most to be feared is intercurrent infection. Only upper respiratory infections were encountered. The hypercortical features disappear a month or so after treatment is discontinued. Occasionally, purple striae appear and remain. The occasional elevation in blood pressure returns to normal within three or four weeks. The increase in appetite is remarkable and accounts for frequent gains in weight, requiring dietary restrictions. No instance of anemia persisting on hormone therapy was found.

DISCUSSION

To those of us who treat rheumatic fever and observe its sequelae, the knowledge of our limitations is still discouraging.

Physicians in the past have been keenly aware that, despite their greatest efforts, success or failure in preventing death or cardiac disability was due in large part to whether there was (1) inflammatory involvement of the heart valves; (2) continued inflammatory activity in the myocardium, with resulting heart enlargement and failure; (3) inflammatory involvement of the neuromuscular tissue, with varying degrees of heart block, occasional paroxysmal auricular tachycardia, or auricular fibrillation; (4) prolonged duration of the attack, with recurrences and continued activity; or (5) no recurrence and no further activity. The prevention of the initial attack at present depends on the timely diagnosis and treatment of streptococcal infection in the susceptible individual. Prevention of future attacks in a known rheumatic individual is now considered possible. Successful immunization appears to be a hope of the future.

An understanding of the peculiar biochemical relationships between the beta-hemolytic streptococcus and the rheumatic individual is still lacking. The concept of the immuno-allergic pathogenesis of rheumatic fever was recently enhanced by the work of Mellors and Ortega.[9] Their work, although specifically concerned with glomerulonephritis, disclosed a feature common to most collagen diseases, namely, the localization of gamma globulin at the site of the lesions. It is assumed that the gamma globulin serves, at least in part, as antibody against antigen that has localized at the site of the lesions. Since so much work has established the streptococcus as the producer of the antigenic substances, the old concept of auto-antibodies acting solely against an intrinsic tissue antigen can be discarded.

In patients with active disease and in those who have recovered from rheumatic fever, the importance of penicillin in preventing hemolytic streptococcal infections has been established without question. A regular prophylactic regimen or, as a lesser choice, the widespread prophylactic treatment of upper respiratory tract infections in known rheumatic fever patients with antibiotics or sulfonamides will doubtless prevent more valvular heart disease than the use of any form of therapy available for the acute attack.

Prior to 1952, acute rheumatic fever was treated with an initial short course of an antibiotic, usually penicillin. It has since been shown that penicillin or another suitable chemotherapeutic drug should be given initially in high dosage for 10 days to ensure the eradication of smoldering streptococcic infection.[1,10] Treatment should then be continued in prophylactic dosage. In 1953 the American Rheumatism Association recommended that this prophylactic treatment be continued in all rheumatic children to the age of 18 years, or for 5 years after an attack of rheumatic fever if this period overlaps or the attack occurs after the age

of eighteen.[1] Early in 1955 this recommendation was changed to lifetime administration of prophylactic penicillin.[10]

It has been my impression that physicians in general have been slow to put into operation this plan of specific prophylaxis. This hesitancy is probably due to the continuing campaign against the indiscriminate use of antibiotics and the many reports of complications of antibiotic therapy. Second in importance to the prevention of future attacks of rheumatic fever and their consequent cardiac damage is the possible prevention of subacute bacterial endocarditis. According to a recent report by Wallach, Lukash, and Angrist,[11] dealing with children under 10 years of age dying of rheumatic heart disease, rheumatic activity is responsible for death in 92 per cent and heart failure resulting from mechanical impairment in 8 per cent. From age 10 through age 19, rheumatic activity causes 52 per cent of deaths, heart failure 12 per cent, and bacterial endocarditis 36 per cent. In later decades, rheumatic activity becomes progressively less important and heart failure more frequent as the cause of death. Bacterial endocarditis is of greater importance during the second through the fifth decades, being responsible for death in 36 per cent, 47 per cent, 39 per cent, and 29 per cent, respectively.

Streptococcus viridans is frequently cultured from the throats of patients on penicillin prophylaxis. Whether the blood level maintained by oral doses of penicillin or monthly injections of benzathine penicillin G is sufficient to prevent these organisms from becoming implanted in the heart valves has not been determined. This is analagous to the concept of prevention of beta-hemolytic streptococcal infection. We occasionally culture these organisms from the throats of patients on prophylactic therapy, especially patients in the hospital wards who are receiving cortisone. However, the organisms do not establish a sustained infection with usual clinical manifestations and subsequent elevation of the antistreptococcal "O" titer.

It is well known that more intensive treatment is usually required to eradicate an established infection caused by either *S. viridans* or beta-hemolytic streptococcus. The regimen of choice for prophylaxis is 169.3 mg (250,000 units) of potassium penicillin G on an empty stomach, 30 minutes before breakfast and at bedtime. After the patient leaves the hospital, the dosage may safely be reduced to 169.3 mg (250,000 units) once daily. Since the advent of long-acting benzathine penicillin G, better control in many instances can be maintained by monthly injections of 990.9 mg (1,200,000 units). This is especially advantageous in hospitalized patients. While the patient is hospitalized, bimonthly injections are preferred because of the increased likelihood of contact with carriers of streptococci. If the patient is sensitive to penicillin, 1 gram of sulfadiazine each morning may be used.

The really important question about the hormones in rheumatic fever is whether or not they will prevent valvular heart disease and other long-term sequelae. We can reasonably conclude after many years of use that salicylates do not prevent a crippled heart. Salicylates do ameliorate the disease, but even when used early in the acute attack valvular disease may still develop. It appears that the main difficulties with hormone therapy have been (1) the tendency to study or observe the patient too long before starting therapy, (2) a hesitancy to use fully suppressive dosage, and (3) the ever-present tendency to discontinue treatment too early or to treat in "courses." There are good explanations for these failures. These include lack of sufficient data on which to make an early diagnosis, the fear of aggravating congestive failure, and the reluctance to changing a patient into a pudgy, acne-spotted caricature of his former self. The difficulty in diagnosis of the atypical case cannot be overcome with present knowledge and laboratory help. Chief reliance is on experience, training, and an acute awareness of rheumatic fever in the differential diagnosis.

In the severely ill patient, especially in the first two decades of life, steroids may often be lifesaving. In general, hormones do not aggravate congestive failure for more than 24 hours or so. If improvement does not occur after 48 hours of treatment, it usually means that the dosage is too small. However, if after the disease is controlled for a few days or a week or so the hormones are discontinued or reduced to ineffective levels, there is usually a prompt recurrence, often more severe than initially. This error in treatment of rheumatic carditis is frequent and grave. It leaves the suppressed adrenal glands unable to react at maximum capacity. Occasionally, rapid deterioration and death ensue. These deaths are sometimes reported as treatment failures.[12] A low sodium diet, mercurial diuretics, digitalis, oxygen, et cetera, often are necessary in such patients during the early phase of therapy. Massell,[8] in reviewing 10 reports of patients with rheumatic carditis treated with hormones, found definite improvement of congestive failure in 75 per cent.

Since corticotropin (ACTH) and cortisone cause a retention of sodium and water, the rapid clearing of signs of congestive failure in my experience is good evidence that the inflammatory process in the myocardium is controlled. Further evidence is the control of gallop rhythm and tachycardia (cases 10 and 12), although the latter often is incompletely controlled until the period of activity is over. Although the patient may be on a seemingly suppressive dosage, in many instances throughout the period of activity turning him in bed or having him sit up is sufficient to produce an abnormal increase in pulse rate. Pericarditis usually clears in a few days as manifested by disappearance of a friction rub. Electrocardiographic changes may take longer,

especially S-T segment elevations and T-wave changes. Some of these T-wave changes are considered to be due to serum potassium fluctuation. The P-R interval, unless it is a fixed prolongation from previous carditis, has returned promptly to normal, in my experience. In some patients the disease cannot be adequately suppressed even with maximum doses of cortisone. However, with this type of patient, it is my belief that it is even more important to continue the cortisone, even though it only partially suppresses the disease. This may prevent severe damage and possibly a fatal outcome during a fulminating course.

The main question of preventing chronic valvular heart disease has not been settled yet. Authors appear to be reluctant to give an opinion on this. One reason for this reluctance is the fact that most patients with recurrent attacks already have valvular damage when seen. New patients often have murmurs when first seen, or develop murmurs prior to starting treatment or prior to being given a definite diagnosis of rheumatic fever. The changing character of murmurs in acute rheumatic carditis is well known. However, after carefully observing and treating patients for the past six years with this question in mind, I am convinced that the progression of valvular damage ceases with the suppression of inflammation by adequate hormone therapy. In general, existing murmurs remain the same or become less pronounced during adequate treatment. On adequate suppressive therapy throughout the period of activity, murmurs, both systolic and diastolic, frequently disappear permanently. If no murmur is present prior to treatment, the patient does not develop one except occasionally in fulminating cases during the first few days before suppressive therapy is effective.

The recent work of Roy and Massell[13] showed disappearance of significant murmurs in 40 per cent of 88 patients. Disappearance of murmurs was twice as common in 47 rheumatic children treated with large doses of cortisone (150 mg daily for an average of 14 weeks) as in a comparable group of 41 children treated with smaller doses (100 mg daily for an average of six weeks). Coste and Oury,[14] in a report of 43 cases, did not see signs of carditis after 48 hours' treatment, if patients were started on hormone therapy before signs of carditis appeared or were started on such therapy in the early stages of carditis. Apparent exceptions to the above will be seen, but if a search is made one will find either inadequate treatment in dosage or duration of hormone therapy, or the likelihood of recurrence of a streptococcal infection in a patient not protected by prophylactic therapy.

The impression gained from clinical observation is that hormone therapy does not shorten the duration of rheumatic activity. This is not intended to imply that short courses are not beneficial. It is reasonable to expect that the ravages in the heart are more

pronounced in the early acute febrile stage. The proliferation of the valvular endocardial and subendocardial cells, often in palisade arrangements with swelling of the interstitial connective tissue and a dense leukocytic infiltration, occurs early during the exudative and proliferative phases of the disease. If this process can be prevented or interrupted in its initial stage, the thickening, fusion, and retraction of valve leaflets that occur repeatedly with each new episode of rheumatic fever can be curtailed. The extent of curtailment depends on variables such as the severity of the process in a particular patient and the adequacy of the hormone dosage administered. The same can be said for the involvement of the myocardium.

The characteristic Aschoff's body is the inflammatory lesion incriminated by pathologists to account for acute dilatation and heart failure. Furthermore, congestive heart failure occurring in the course of chronic valvular heart disease is now considered to be due to reactivation or continued activity of myocarditis. Murphy[15] has demonstrated that these Aschoff's bodies develop in and from injured myofibers that are being necrotized. The intimal and medial changes in small arteries supplying the auriculoventricular conductive tissue as well as the edema and infiltration with polymorphonuclear cells, lymphocytes, and plasma cells of this tissue probably account for the irregularities and heart block that appear temporarily. Whether this is true or whether the Aschoff's body is responsible remains to be established. The Aschoff's body is peculiar to the myocardium and does not appear in the inflammatory valvulitis, endocarditis, or pericarditis of rheumatic fever.

Finally, it is necessary to adopt a concept of management of rheumatic fever similar in many ways to that of tuberculosis. This is especially true in the Armed Forces. The military patient must be hospitalized throughout his illness and convalescence. Children and other dependents need hospital care for relatively short periods when hormone suppression is used. After the acute symptoms and signs in the rheumatic child are normal, strict bed rest is neither practical nor desirable. Supervision by a parent at home with weekly office visits has proved a most satisfactory practice.

SUMMARY

The results of treatment with cortisone of 38 patients with acute rheumatic carditis are reported. Treatment was continued in sufficient dosage to suppress the rheumatic activity throughout the period of immuno-allergic reaction in all but two patients.

Twenty-three of the 38 patients (60,5 per cent) were left with no evidence of heart damage. Thirty-three patients had significant murmurs. In 19 (57.8 per cent), these disappeared during treatment and remained absent throughout the follow-up period.

All patients were treated with chemotherapeutic drugs in therapeutic dosage early, and in prophylactic dosage thereafter. No recurrences of rheumatic fever were apparent.

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A NEW OVERHEAD ANESTHETIC PANEL FOR PIPED GASES, VACUUM, AND ELECTRIC OUTLETS

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IN THE PAST three decades, great strides have been made in the field of anesthesiology. One of these advances was the introduction at the University of Wisconsin of the first central gas piping system.[1] Since that time, the practice of central piping spread to other hospitals throughout the country, and the technics and equipment have been perfected so that today there is a high degree of safety, efficiency, and economy. One problem that still remains in the operating room area, however, is the handling of the high-pressure rubber tubing connecting the gas machine to the outlet.

Several attempts have been made to overcome this problem by the use of wells or "islands" beneath the table, suspension from the ceiling or wall by means of arms or overhead cranes, and suspension poles that extend from the floor to the ceiling. These all have the disadvantage of being cumbersome and usually still leave the tubing hanging at dangerously low levels.

Another problem in the modern operating room is that of the steadily increasing need for more electric connections. This stems from the anesthesiologist's greater utilization of electronic instruments in helping him keep track of the patient's condition. In addition to these monitoring devices, the advent of intracardiac surgery with pump oxygenators requires even more electric outlets conveniently placed. This introduces the hazard of electric cords strewn about the operating room where they can be stepped on, worn, frayed, or unplugged by people walking about.

In planning the operating rooms of the new U. S. Naval Hospital at Great Lakes, Ill., it was decided, after much consideration and consultation, that the use of a fixed overhead panel

From U. S. Naval Hospital, Great Lakes, Ill., and Mayo Foundation, Rochester, Minn.

for piped gases, vacuum, and electric outlets would most ideally solve the above problems.

As shown in figure 1, the panel consists of a stainless steel housing about 28 inches long and 9 inches wide, fastened directly to the ceiling construction over and behind the position of the gas machine. At the lower end of the panel are outlets for oxygen, nitrous oxide, and vacuum. These are connected to their respective hoses with noninterchangeable connectors. At each end of the panel there is a duplex, explosion-proof electric outlet.

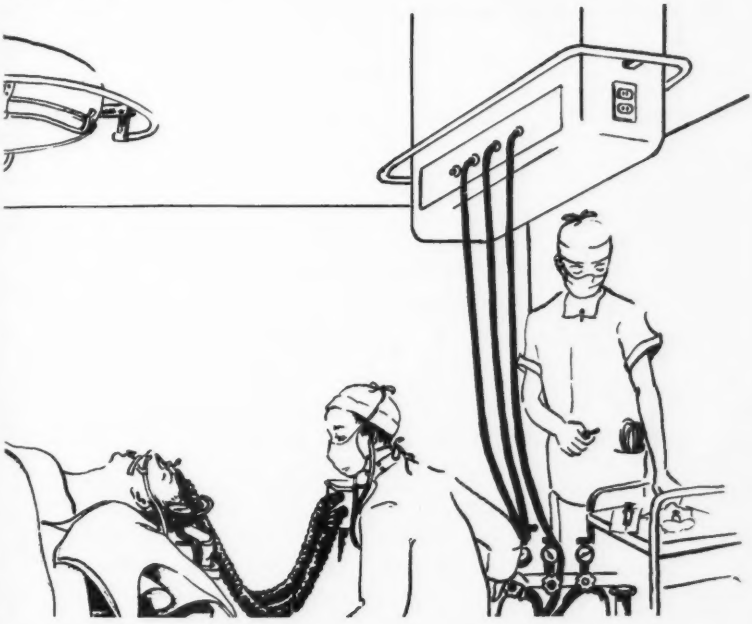

Figure 1. Overhead utility panel as it will appear in use during an operation.

There is a stainless steel tubing encircling the panel 10 inches from the bottom, from which intravenous fluid bottles can be suspended or the rubber tubes draped at the end of the day.

The lowermost part of the panel is about 6 feet 2 inches from the floor, this being a height easily reached by all and not low enough to be hazardous. To increase safety, the corners are rounded at the bottom.

SUMMARY

We have briefly described the new, fixed, overhead anesthetic panel for piped gases, vacuum, and electric outlets that is to

be installed at the new U. S. Naval Hospital at Great Lakes, Ill. The primary purpose is to keep electric wires and high-pressure tubes off the operating room floor, where they so often are a hazard to patient and personnel alike.

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CANCER OF THE COLON AND RECTUM

"Analysis of data from 901 patients operated on for cancer of the colon and rectum yielded valuable diagnostic and prognostic results. Diagnostically, a palpable mass had been detectable in 55.6% of the cases in which the lesion was in the anus, rectum, or rectosigmoid part of the colon, and 70% of all lesions of the colon and rectum were within reach of a 25-cm (10-in.) sigmoidoscope. When the lesion was confined to the colon, it was palpable on abdominal examination in 29.6% of the cases. Prognostically, the absolute survival rate for the entire series was 43%. The operative mortality for the entire group of 901 patients was 5.6%."

—NEIL W. SWINTON, M. D.
RUSSELL L. COUNTS, M. D.
in *Journal of American Medical Association*
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EFFECT OF PROCLORPERAZINE ON PSYCHOLOGIC, PSYCHOMOTOR, AND MUSCULAR PERFORMANCE

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DURING recent years, tranquilizing agents have gained great prominence in clinical practice. As Brücke[1] pointed out, however, these drugs possess an almost infinite number of properties. This raises the problem of the nature of various effects produced and their relation to the tranquilizing effect. The investigation herein reported approached this problem by using one drug and one dose level in a great variety of tests.

MATERIALS AND METHODS

The drug used was Compazine (brand of proclorperazine) which is an analogue of chlorpromazine. The dose was 10 mg. This produces a marked tranquilizing effect without interfering with the normal daily activities of the subject. The only side effect that might be expected is a slight somnolence. In order to differentiate between the true tranquilizing effect of the drug and this side effect, one control group was given not a pure placebo, but 10 mg of phenobarbital. A second control group received no drug.

The experiments were divided into three groups: (1) 10 mg of proclorperazine was given by mouth one hour before the start of the experiment; (2) 10 mg of phenobarbital was given by mouth one hour before the start of the experiment; (3) no medication was given. The drugs were supplied under code number, so that neither the subject nor the experimenter knew which drug was being tested.

Eighteen men, 20 to 43 years of age and with no known clinical disturbance, were chosen as subjects. Six of these subjects served for two series of experiments. Each subject was tested under the three experimental conditions, and for statis-

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tical evaluation each subject served as his own control. In order to eliminate as far as possible any effect of environmental conditions such as room temperature, noise level, and time of day, three subjects were always tested simultaneously, one under each of the three possible experimental conditions.

The following tests were used as an indication of psychologic, psychomotor, and muscular performance.

Mental Performance

Memory of numbers. Numbers were given, increasing from four to nine digits, and the subject had to write them down after a short interval. This test was analyzed as to the maximum span achieved and the total number of mistakes.

Crossing "E." All E's on a page of printed material had to be crossed out. This test was analyzed for the number of lines attempted within the 3-minute test period and for the number of mistakes and omissions.

Code substitution. Three lines were given, and the fourth one had to be filled in. The first line consisted of the letters of the alphabet arranged in correct order. In the second line, numbers were given in random order corresponding to each letter of the first line. The third line gave an arbitrary combination of letters, and the corresponding numbers had to be filled in from the code given in the upper two lines.

Time Perception

Free time estimate. The subject had to estimate an interval of one minute, and the actual time was recorded.

Tapping. The subject was asked to tap out 60 seconds on a Veeder-Root counter, and the actual time was recorded.

Reaction Time

Simple reaction time. A 360-millisecond time clock was arranged with two interruption switches. The operator started the clock with a click. The subject, when hearing the click, had to stop it as soon as possible by pressing his switch.

Choice reaction time. The same arrangement as in simple reaction time was used; however, this time the subject was told to respond only to one of two sounds of slightly different frequencies. The reaction time and the number of false responses were recorded.

Reflex Activity

Patellar reflex was determined by having a percussion hammer suspended in such a manner that on release it hit the tendon with controlled force. The movement of the leg was registered

by fixing a string to the heel. This movement was converted into vertical deflection and the amplitude was recorded on a kymograph.

Pain Threshold

The volar side of the forearm was painted with India ink to assure maximum heat absorption. Initial skin temperature was determined with a radiometer. The arm was then exposed to a known amount of radiant heat (200 mc/sec/cm^2) and the time was recorded when the subject reported the first pricking pain.[2] The final skin temperature was then calculated from Buettner's[3] formula.

Hearing Impairment

Hearing loss was determined with a Maico audiometer for 250, 1,000, and 6,000 cycles per second. The three values for hearing loss were combined to give one value for hearing impairment.[4]

Muscular Co-ordination

Punchboard. A plastic board had three holes arranged as a unilateral triangle with a side length of 4 inches. A metal stylus fitted the holes and a shoulder stopped the punch at a depth of 3/16 inch. The subject was asked to punch the three holes in sequence as rapidly as possible. The number of punches for a 3-minute period were counted.

Rotary pursuit device. The subject had to follow with a stylus an irregular line on a rotating kymograph. The mistakes were automatically recorded on an Esterline-Angus ammeter. Any aberration caused a deflection, and the time of aberration determined the amplitude of the deflection. The results were analyzed as to the number of mistakes and as to the product of the number of mistakes and magnitude of deviation read in the arbitrary line units of the recording instrument.

Muscular Performance

The heart rate, respiratory rate, respiratory minute volume, and oxygen concentration of expired air were determined, after which the changes in these values were observed during a 10-minute period of exercise and during 4 minutes of recovery. An ergometer bicycle with a wheel circumference of 1.96 meters was used. The resistance was 4 pounds, and the rate of revolution was fixed with a metronome at 40 revolutions per minute. Heart rate was determined with an electrocardiograph. Respiratory measurements were made with a Hutchinson respirometer. For the oxygen analysis, a Beckman model D oxygen analyzer was used. Data were collected immediately before exercise, 3 minutes after the start of exercise, 8 minutes after the start of exercise, and 3 minutes after the end of exercise. All experiments

were analysed as an individual comparison, taking each subject as his own control.

RESULTS AND DISCUSSION

Results 1 to 6 in table 1 give data on tests primarily involving mental performance. The differences for any single test are not significant, but if the number of mistakes for crossing "E" (result 4) are combined with those of the code substitution test (result 5), the difference between the proclorperazine and no drug groups is significant ($p=0.05$). Such a combination may be justified, as the two tests show a good correlation ($r=0.65$); however, this change may not be specific, inasmuch as the phenobarbital group shows the same trend.

Time perception (results 7 to 11) was not affected by either of the drugs, and if simple reaction time and choice reaction time are considered separately there also is no significant change. If the two are combined ($r=0.53$), however, there is a significant drug effect that appears to be specific to the proclorperazine group.

The initial skin temperature was slightly higher in the group using proclorperazine (result 12) but the difference is not significant. In view of the known vasodilator action of such drugs,[5,6] however, this difference might be significant with a higher dose. There was no change in the pain threshold (result 13), and no impairment of hearing (result 14). The amplitude of the patellar reflex (result 15) was decreased in the proclorperazine group, whereas phenobarbital had no effect. In tests primarily involving muscular co-ordination (results 16 to 18), there was inhibition in the proclorperazine group. The differences are not all significant, but the trend is the same in all tests.

On the whole there appears to be very little effect in tests primarily involving mental function, whereas those tests largely involving muscular activity show impairment. To further elucidate this point, the effect of proclorperazine on muscular exercise was determined. Table 2 shows that in the pre-exercise period there was no significant difference between groups. During exercise the only changes were increase of pulse rate and oxygen consumption in the proclorperazine group. The differences were slight, and they become significant only if the 3- and 8-minute periods are combined.

In the postexercise period there was a change in pulse rate and oxygen consumption in the same direction as during exercise; however, the differences were not significant. The increased heart rate and the increased oxygen consumption for the proclorperazine group during exercise indicate a decreased efficiency of work performance, as confirmed by calculated efficiency values. An inhibition of muscular efficiency also is sup-

TABLE 1. *Effect on psychologic and psychomotor performance of 10 mg proclorperazine compared with 10 mg phenobarbital and with no medication*

Result Number	Type of test	Number of		Group			P values	
		Subjects	Tests	Proclor-perazine	Pheno-barbital	No drug	Proclor-perazine Pheno-barbital	Proclor-perazine no drug
1	Memory (span)	21	63	6.2	6.3	6.3		
2	Memory (mistakes)	21	63	6.4	5.8	7.4		
3	Crossing "E" (lines)	24	72	38.6	39.3	39.2		
4	Crossing "E" (mistakes)	24	72	4.2	3.7	2.7		
5	Code-substitution (mistakes)	24	72	0.42	0.40	0.29		0.05
6	Code substitution (time, sec)	24	72	179.1	179.3	179.0		
7	Time tapping (60 sec)	24	72	61.7	60.0	59.7		
8	Time estimate (1 minute)	24	72	70.0	70.6	69.7		
9	Simple reaction time	24	720	176	171	169	0.05	0.05
10	Choice reaction time (time)	24	720	254	251	251		
11	Choice reaction time (mistakes)	24	720	2.00	1.63	1.83		
12	Skin temperature (°C)	24	72	33.7	33.4	33.3		
13	Pain threshold (°C)	20	180	45.4	45.8	45.7		
14	Hearing Impairment (%)	24	72	3.4	3.5	3.4		
15	Patellar reflex (amplitude, mm)	24	72	31.8	35.4	36.6	0.05	0.01
16	Punchboard (no./ 3 min)	24	72	109	112	111		
17	Rotary pursuit (dev.)	24	72	6.8	4.8	4.8	0.05	
18	Rotary pursuit (units)	24	72	29.2	17.5	18.1	0.05	0.06

TABLE 2. *Effect on muscular performance of 10 mg proclorperazine compared with 10 mg phenobarbital and with no medication*

	Group			P values	
	Proclor-perazine	Pheno-barbital	No drug	Proclor-perazine Pheno-barbital	Proclor-perazine no drug
	Pre-exercise				
Pulse rate	73.8	74.3	74.8		
Respiratory rate	11.7	11.6	11.6		
Tidal volume (ml)	1,075	1,034	1,053		
Respiratory minute volume (l)	12.08	11.99	11.89		
0_2 concentration (%)	16.95	16.96	16.94		
0_2 consumption (ml/min)	489	484	483		
	Exercise (3 and 8 minute periods)				
Pulse rate	112.1 112.9	111.9 112.0	108.3 109.8		0.05
Respiratory rate	14.8 15.0	15.2 15.8	15.0 15.3		
Tidal volume (ml)	1,767 1,764	1,607 1,669	1,701 1,750		
Respiratory minute volume (l)	26.16 26.64	24.42 26.37	25.52 26.78		
0_2 concentration (%)	15.31 15.24	15.30 15.38	15.44 15.48		
0_2 consumption (ml/min)	1,489 1,524	1,392 1,482	1,419 1,479	0.05	0.05
	Postexercise (3 minutes after end of exercise)				
Pulse rate	86.2	84.3	83.8		
Respiratory rate	11.8	11.8	11.9		
Tidal volume (ml)	948	957	945		
Respiratory minute volume (l)	11.18	11.29	11.24		
0_2 concentration (%)	16.91	17.16	17.11		
0_2 consumption (ml/min)	457	434	437		

ported by the fact that in 7 runs out of 24 the subjects taking proclorperazine volunteered the information that they found the work tiring, while no similar reports were made in the other groups.

In the clinical use of chlorpromazine, one of the side effects is parkinsonism, which occurs in about 10 per cent of all patients under intensive treatment.[7,8] The present investigation indicates that there is inhibition of muscular performance even with very low doses of proclorperazine, as shown by the increased reaction time, the decreased amplitude of the patellar reflex, the decreased performance in tests of muscular co-ordination, and the decreased efficiency in muscular exercise. Inasmuch as the patellar reflex is a spinal reflex, central depression would tend to increase the response. A decreased reflex activity might be an indication that the site of drug action is peripheral rather than central. The investigations of Courvoisier and associates[9] and Archer[10] support such an interpretation. Dasgupta and Werner[11] thought that there is muscular inhibition and that it is due to depression of the reticular formation, but their experimental findings do not contradict a peripheral drug action. Dyrberg and Hougs[12] did not find any change in the muscle action potential, but it is difficult to draw any conclusions from a negative experiment.

We must be careful not to generalize these findings, as only one of the tranquilizing agents was used in this investigation and we do not know whether other agents produce the same effect. Some of the effects probably would be more clearly revealed if various dose levels of the drug were used; however, a dose sufficiently high to give a dose-response curve might interfere with the daily activities of the subjects. Finally, we do not know to what extent clinically disturbed patients would show the same reactions as the normal subjects used in these experiments.

SUMMARY

The effect of 10 mg of Compazine (brand of proclorperazine) was compared with that of 10 mg of phenobarbital and with that of no drugs, in a series of double blind tests, using 18 subjects. Tests of hearing and pain perception and tests primarily involving mental performance did not show any specific changes. Tests involving muscular co-ordination, however, showed a lower performance, and tests of muscular exercise showed a decreased efficiency.

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CORONARY DISEASE AND RACE

"The death rates from coronary disease during the past 15 years have increased much faster among nonwhites than among white persons. Much of this may reflect the increasing exposure of the nonwhite population to modern medicine, as a result of large scale migration from the rural South to northern cities."

—*Statistical Bulletin*
Metropolitan Life Insurance Co.
p. 2, Feb. 1957

WEEVER STINGS AND THEIR MEDICAL MANAGEMENT

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MEMBERS of the piscine family Trachinidae, the weevers, probably are the most venomous of temperate zone marine fishes. Trachinids are largely confined to the eastern Atlantic and Mediterranean coasts. They are relatively small fishes, the largest of which, *Trachinus draco*, is not known to exceed a total length of 18 inches.

Weevers are primarily inhabitants of flat, sandy, or muddy bays. During the spring and early summer, they migrate into shallow waters to spawn. Trachinids have the habit of burrowing in the soft sand or mud, with only their heads partially exposed, and darting out at their prey. Despite their sedentary habits, weevers can move with great rapidity and are said to be able to strike an object with their opercular stings with unerring accuracy. Because of their habit of concealment, aggressive attitude, and highly developed venom apparatus, they constitute a hazard of which shallow-water divers, fishermen, and swimmers should be aware. Weever stings may be extremely painful, and on occasion may cause death.

The four species of weevers and their distribution are as follows:

Trachinus araneus Cuvier (fig. 1); Portugal, Mediterranean Sea, southward along the Atlantic coast of North Africa.

Trachinus draco Linnaeus (fig. 2); Norway, British Isles, southward to Mediterranean Sea, and coasts of North Africa.

Trachinus radiatus Cuvier (fig. 3); Mediterranean Sea, southward along the west coast of Africa.

Trachinus vipera Cuvier (fig. 4); North Sea, southward along the coast of Europe, and Mediterranean Sea.

From U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

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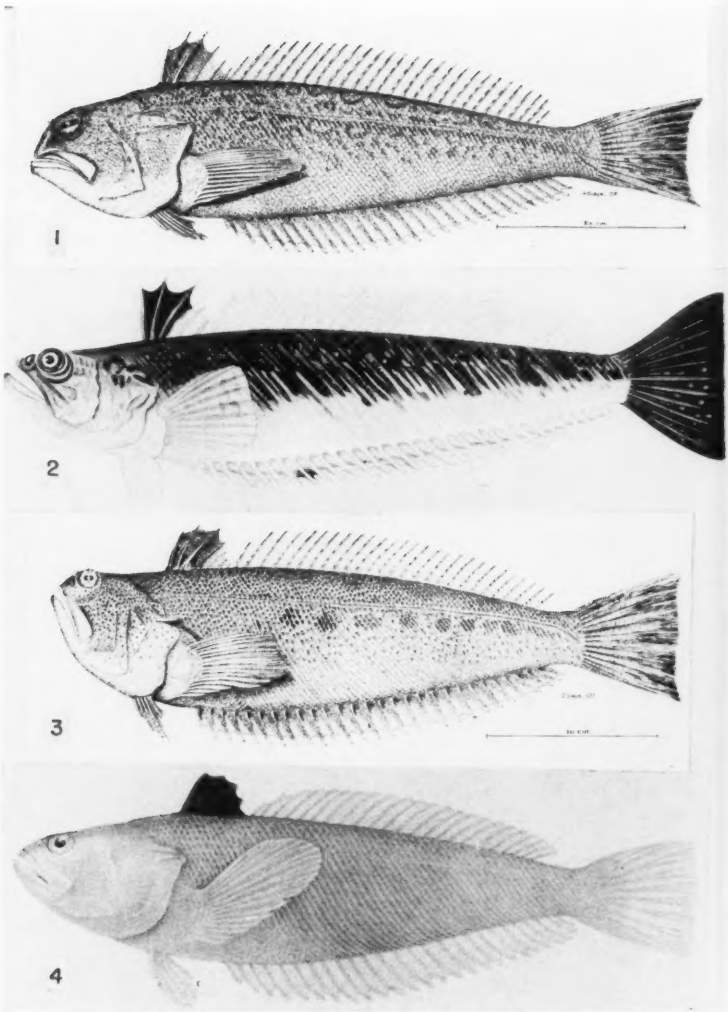

Figure 1. Trachinus araneus *Cuvier. (Courtesy of Smithsonian Institution.) Figure 2.* Trachinus draco *Linnaeus. Figure 3.* Trachinus radiatus *Cuvier. (Courtesy of Smithsonian Institution.) Figure 4.* Trachinus vipera *Cuvier.*

Weevers have been given a great variety of vernacular names. Some of the more common ones are: sand-eel-bill, sea-cat, catfish, stingbull, mor wiber fawr, adder-pike, black-fin, stingster, stang, stinger, spider, sea dragon (England), araneus, draco, dracunculus, tragine (Ancient Latin) fibersing, foersing (Sweden), fjärsing, fjäsing, (Denmark), petermänchen, drachenfische, schwertfisch, ragno (Germany), pietermann, pietervisch, arend, meerlan, stekelvisch, stekeltje, pukkel, puikeling, puikel, puikelsar (Holland), vive, avive, aragna, iragna, iapouricha, bois de roc, boudereux, toqet, claquedit (France), arana, escorpion (Spain), joh, zanj, zanja, zanjen, draganja, taranta (Yugoslavia), drakaina (Greece), lomole, abo, and abohor (Gold Coast).

The venom apparatus of weevers consists of five to seven dorsal spines, an opercular spine on each side of the head, and the associated venom glands (fig. 5). The glands of both the

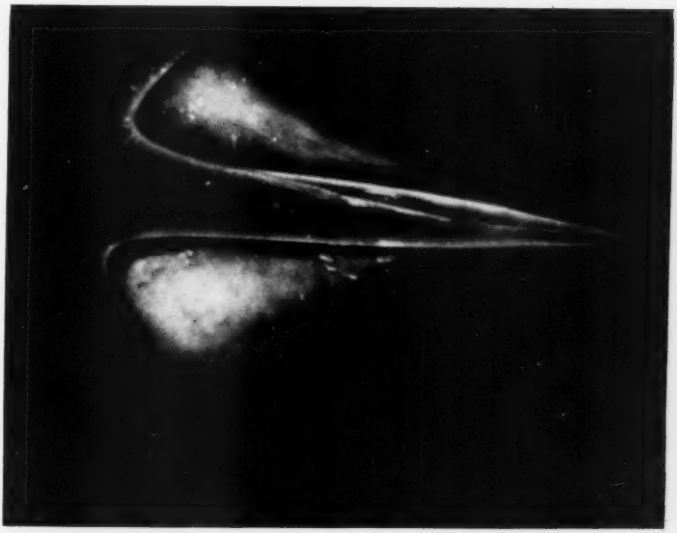

Figure 5. Photograph of a lateral view of the opercular sting of Trachinus vipera. *The integumentary sheath has been removed to reveal the underlying glands.*

opercular and dorsal stings consist of masses of large, polygonal, variable-sized, distended, light pink cells, filled with finely granular secretion (fig. 6). A detailed morphologic description of this venom apparatus is being published elsewhere.[1]

Wounds usually are received while wading with bare feet in sandy areas inhabited by weevers. Stings from *Trachinus draco*,

the deep-water species, most commonly occur among fishermen in attempting to remove them from their nets. Because of the danger of stings from dead fishes, some of the towns in France have passed police regulations making it illegal to sell weevers without first cutting off their stings.

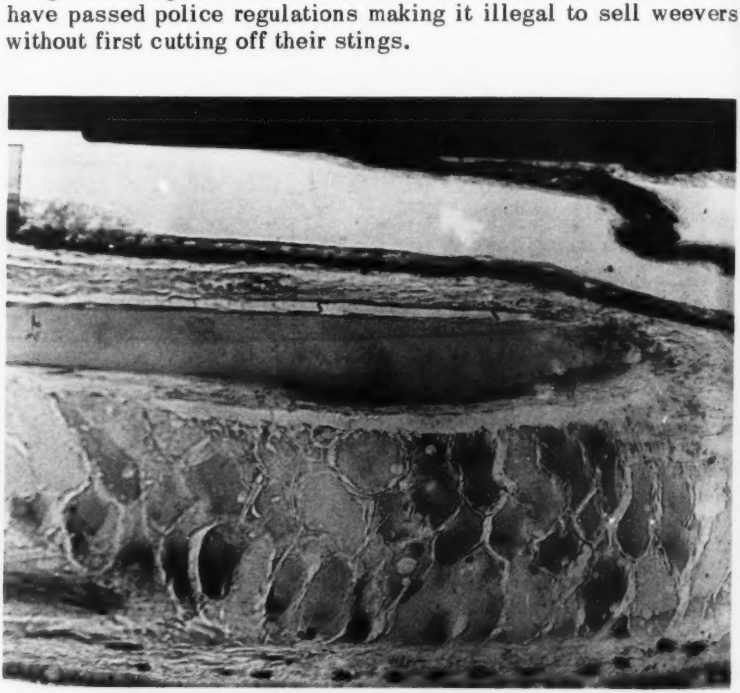

Figure 6. Longitudinal section of the opercular sting of Trachinus vipera. *(× 140)*

CLINICAL CHARACTERISTICS OF STINGS

Weever wounds generally produce instantaneous pain, described as a burning, stabbing, or crushing sensation that initially is confined to the area about the wound and then gradually radiates throughout the affected limb. The pain becomes progressively more severe until it attains an excruciating peak, usually within 30 minutes or less. The severity of the pain is such that the victim frequently screams in agony, threshes about wildly, and may lose consciousness. Bouriense[2] reported a case in which the pain was so violent that the individual finally amputated his finger, thereby obtaining prompt relief. Evans[1] mentioned fishermen hammering their fingers with a thole pin and others wrapping the wound with vinegar-soaked paper and lighting the paper, in a desperate effort to deaden the pain. In most reported instances, morphine fails to give relief. If untreated, the pain usually subsides within a period of 2 to 24 hours.

Tingling, followed by numbness, subsequently develops in the area about the wound. This is soon followed by redness, heat, and swelling. The edema is progressive, and within a half hour or more the entire limb is involved. Movement of the affected part is greatly restricted. The swelling may continue for a period of 10 days or longer. These initial symptoms of pain and inflammation may be associated with or followed by headache, fever, chills, delirium, nausea, vomiting, syncope, sweating, cyanosis, joint aches, ankylosis, aphonia, torpidity, cardiac palpitation, bradycardia, pronounced psychotic depression, respiratory distress, clonic or tonic convulsions, and death. Primary shock is a usual complication that must be guarded against, and secondary infections commonly occur in improperly treated cases. Lymphangitis, lymphadenitis, pyogenesis, and necrosis and sloughing of the tissue about the wound are not infrequent. Gangrene may develop, necessitating amputation.

The recovery period is extremely variable. Depending on the individual, amount of venom injected, species of weever, season of the year, and possibly the locality, the period varies from a few days to several months. In 1885, Bottard[4] reported a case which was complicated by a severe secondary infection that resulted in atrophy of the index finger, peripheral neuritis, and ankylosis. More than three years later the patient still was unable to touch an object with the affected finger without severe pain. De Marco[5] presented an interesting case of a 15-year-old boy in whom a weever sting on one of his fingers appeared to have stimulated a generalized epileptiform attack, and concluded that the venom acts as a cortical sensory-motor stimulant. Additional clinical reports have been written by Gressin,[6] Coutière,[7] Phisalix,[8] and Giunio.[9]

CASE REPORT

On 24 July 1955 a 31-year-old Austrian zoologist was skin-diving about 200 meters off the Port of St. Angelo, Ischia Island, near Naples, Italy, at a depth of about 6 meters in the vicinity of a sand bank. In diving to the bottom, he observed an unusually large weever, believed to be *Trachinus vipera,* lying partially buried in the sand. The fish did not appear to be disturbed by the intrusion, and permitted him to touch it; then, suddenly, it moved through the sand in a snake-like fashion and quickly turned facing the diver with fins vibrating in a most aggressive manner. Before he was able to withdraw, the weever darted at him and struck at him twice, the first time striking only his face mask, and then his right jaw.

Initially, the wound bled profusely, but without pain. This soon was followed by a stinging sensation not unlike that of a bee sting, and the bleeding ceased. The pain rapidly increased in intensity and

took the form of a severe "neuralgic pain," involving the head and upper part of the chest. It became so severe that movement in the water was increasingly difficult, but the diver finally managed to reach shore.

After about 15 minutes, respiration became difficult and effort was required in order to continue breathing. The respiratory distress was relieved after about 10 minutes. The victim then noted that his ability to observe peoples' actions and voices was somewhat dulled; their movement and speech seemed to be greatly retarded. The injured side of his face gradually became inflamed, although the actual wound site was only pinpoint in size.

The pain became "unbearably intense" and radiated outward from the jaw to involve all of the head and most of the chest. The victim groaned with the extreme pain, and requested that someone shoot him and put him out of his misery. Upon the arrival of a physician he was given an injection of meperidine hydrochloride (amount not stated), but without relief. Two hours later he was given morphine sulfate, again without effect. This was repeated soon after, without result.

In about five hours, the patient developed a severe burning sensation affecting the entire skin area of his chest. The area about his head became progressively swollen, reaching its greatest proportions on the second day. The first day the skin on the upper part of his body took on an erythematous hue, gradually becoming cyanotic on the second day. There also developed during this same period a massive hematoma involving a large part of the face, greater part of the head, neck, and upper part of the chest. The swelling was sufficiently extensive to impair breathing and swallowing. Movement of his thoracic muscles became exceedingly painful.

On the fourth day, the patient was transferred from Ischia Island to the International Hospital in Naples, where he was examined by the Medical Director, Dr. Paul Burkhard, who kindly provided this case history. At the time of admission, the patient complained of pains in the right cheek, neck, thorax, scapular region, and skin of the head. These areas were greatly edematous and firm, with evidence of extravasation of blood into the tissues (figs. 7 and 8). At this time the patient was suffering from severe dyspnea, because of the massive edema about the throat, but within a day or two after his arrival at the hospital he began to improve rapidly.

Upon entry to the hospital, the patient's temperature varied between 99° and 101°F, with pulse rate between 99 per min and 100 per min. Blood pressure was 130/85 mm Hg; red blood cell count, 3,820,000 per μl; hemoglobin, 82 per cent; platelet count, 240,000 per μl; white blood cell count, 13,600 per μl; neutrophils, 77 per cent; lymphocytes, 11 per cent: monocytes, 11 per cent; eosinophils, 1 per cent; baso-

phils and plasma cells, none. The lymphocytes showed no toxic granulation. Specific gravity of the urine was 1.028, and urobilinogen was normal. There were no other findings of significance.

Figure 7. Appearance of patient who had been stung by a weever, believed to be Trachinus vipera. *Note edematous areas and extravasation of blood into tissues.*

Family History. The patient had a brother who died at the age of 14 years, supposedly of hemophilia, and he himself had a number of hemorrhages as a boy, for which he was treated with vitamin-K therapy. He had had no recent hemorrhages.

Treatment was symptomatic. Oxygen was administered for two days during the period of respiratory embarrassment, and cold, moist compresses were applied to the areas of swelling. Various opiates were administered but were ineffective. Solutions of vitamins, calcium, and glucose were given intravenously during hospitalization.

Figure 8. Full view of patient shown in figure 7, showing marked edema of right cheek.

The patient was discharged after 10 days of hospitalization, at which time the swelling on the right side of the face, neck, and right shoulder had almost disappeared, although the skin was still discolored. There was no pain or respiratory distress, and recovery was uneventful.

TREATMENT

There are no known specific antidotes for weever venom, and treatment is for the most part symptomatic. Effort should be directed toward alleviating pain, combating the effects of the venom, and preventing secondary infection. The pain results from the trauma produced by the fish spine, the venom, and the slime and other irritating foreign substances introduced into the wound.

Weever stings usually are of the puncture-wound variety, and removal of the venom is difficult. If seen early, it is sometimes advisable to make a small incision across the wound and apply suction. Irrigation of the wound with cold salt water is helpful, but generally is not possible in weever stings.

There is a division of opinion as to the advisability and efficacy of using a ligature in the treatment of fish stings. If used, it should be placed at once between the site of the sting and the body, but as near the wound as possible. The ligature should be released every few minutes in order to maintain adequate circulation.

Whether or not a ligature is used, the member should be soaked in hot water for 30 minutes to an hour. The water should be maintained at as high a temperature as the patient can tolerate and as can be used without injury. This treatment should be instituted as soon as possible. If the injury is to the face or body, hot moist compresses should be employed. High temperatures attenuate the potency of the venom. The addition of magnesium sulfate or epsom salts to the water is believed to be useful.

Infiltration of the wound area with 0.5 to 2 per cent procaine hydrochloride has been tried with good results. If local measures prove unsatisfactory, intramuscular or intravenous meperidine hydrochloride generally will be efficacious. Lacerations should be closed with dermal sutures and the injured area covered with an antiseptic and a sterile dressing.

Prompt institution of the recommended treatment usually eliminates the necessity for antibiotic therapy, but if delay has resulted to any extent, antibiotics may be desirable. A course of tetanus antitoxin is an advisable precautionary measure.

The primary shock that immediately follows the stinging generally responds to simple supportive measures. However, the secondary shock resulting from the action of the venom may require immediate and vigorous therapy. Treatment should be directed toward maintaining cardiovascular tone and the prevention of any further complications. Respiratory stimulants may be required. Some of the advice given by Russell[10] in his excellent

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review on the treatment of sting ray stings probably is pertinent to the handling of injuries produced by weevers.

Stahnke[11, 12] recommended a treatment for venomous animal stings that differs considerably from the preceding. The treatment is known as the L-C (ligature-cryotherapy) method. Immediately after being stung, and without making an incision, the victim places a ligature between the site of the sting and the body at the point nearest the entrance of the venom. The hand or foot, including the ligature, is immersed in iced water. The ligature is removed after the member has been in iced water for not less than 5 or more than 10 minutes, but the affected part must remain in the iced water for a minimum of 2 hours. There is said to be no danger of frostbite if ice water alone is used; salt must not be added. Stahnke stated that this method has been employed several times in cases of sting ray stings, with good results. There are no known instances in which it has been employed for weever stings.

TOXICOLOGY

Winkler,[13] Schmidt,[14] Gressin,[6] Coutière,[7] Pohl,[15] and Phisalix[16] tested crude extracts of weever venom on various laboratory animals, but their studies were of a general nature and revealed little of the pharmacologic properties of the venom. Briot[17–21] and Evans[3, 22–24] have shown weever venom to possess antigenic properties and to have a hemolytic effect on mammalian red blood cells. De Marco[5, 25, 26] reported that weever venom injected into the dorsal lymph sac of frogs results in reflex excitability, tonic and clonic convulsions, paralysis, loss of position and spinal reflexes, and death. Nothing is known of the chemistry of weever venom.

SUMMARY

Weevers probably are the most venomous of temperate zone marine fishes. Because of their habit of concealment, aggressive attitude, and virulent venom apparatus, they constitute a hazard to divers, swimmers, and fishermen. The four known species, *Trachinus araneus*, *Trachinus draco*, *Trachinus radiatus*, and *Trachinus vipera*, are largely confined to the eastern Atlantic and Mediterranean coasts. The venom apparatus consists of dorsal and opercular stings. Wounds produced by these fishes are extremely painful and may result in death. A recent case is discussed in detail. Treatment is largely symptomatic. There are no known specific antidotes. The pharmacologic and chemical properties of weever venom are largely unknown. Animal studies suggest that the venom contains both neurotoxic and hemotoxic fractions. Additional research on the subject is needed.

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SUITABILITY OF IVALON SPONGE TUBES FOR REPLACING VASCULAR SEGMENTS

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THE PHYSICAL properties of Ivalon (polyvinyl formal sponge) are such that this material appears to offer many advantages not available with other synthetic materials for use in replacement of vascular segments. Among these advantages are the ease of fabrication of straight or branched tubes; the consistency and texture of the finished product, which facilitates handling, suturing, and tailoring to the requirements of a given situation; and the porosity of the substance, which is compatible with tissue infiltration. Several workers have carried out investigations to adapt this material to vascular surgery,[1-5] and some of these reports have been encouraging.

This presentation is the result of the trial of Ivalon for replacing segments of abdominal and thoracic aorta in dogs.

MATERIALS AND METHODS

Types of Ivalon Sponge. Four types were used: (1) Rubatex Ivalon, porous, in sheets ½ inch thick, Type F-451-V, manufactured by Rubatex Division of Great American Industries, Inc., Bedford, Va.; (2) Rubatex Ivalon, compact, in sheets ¼ inch thick, Type R-401-V; (3) Clay-Adams Ivalon surgical sponge—Formulation M, in bricks, obtained from Clay-Adams Co. Inc., New York 10, N. Y.; and (4) Prosthex Ivalon surgical sponge in bricks, obtained from the Ramer Chemical Company, Ltd., Surrey, England.

Rubatex Ivalon. Both the compact and porous material appeared to have satisfactory elasticity, softness, porosity, and strength, and seemed physically excellent for the purpose intended, but the manufacture of tubes proved to be difficult. Preparation by boiling 15 to 30 minutes did not result in adequate fusion or adhesion, and preparation by use of dry heat at higher tempera-

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tures required excessive compression of the sponge in order to attain satisfactory fusion, thus losing porosity. These disadvantages were particularly noticeable with the compact material, but apply to the porous as well.

Clay-Adams Ivalon Surgical Sponge. This material proved very satisfactory to work with. Boiling produced tubes with excellent initial strength. The major disadvantage was the nonuniform pore size of this product. Frequent large bubbles resulted in areas of weakness or leaks of the finished tube wall.

Prosthex Ivalon Surgical Sponge. This material is similar to the Clay-Adams product, but has the advantage of more uniform pore size.

Molds. Glass, polished stainless steel, copper, and brass rods or tubes having parallel or tapered sides were used to mold the Ivalon tubes. No branched segments were constructed because this study did not involve the use of complex grafts. For straight tubes, either glass or stainless steel molds were highly satisfactory. In the later stages of the work, slightly tapered molds were used to achieve a closer approximation to the size of the host vessel at both ends of the graft.

Animals. Mongrel dogs ranging from 10 to 20 kg in weight were used. All animals were inoculated against distemper and hepatitis, and dewormed preoperatively. Anesthesia was produced with intravenous pentobarbital sodium, 15 to 30 mg per kg. Ventilation during surgery was achieved by connecting a Pneophore* respirator to a metal endotracheal cannula and using 100 per cent oxygen. All animals were given 180 mg (300,000 units) of penicillin and 1 gram of streptomycin daily for the first 4 postoperative days.

Surgical Technics. Abdominal aortic grafts were placed between the renal vessels and the trifurcation of the aorta. The grafted segment was covered with peritoneum routinely. Thoracic aortic grafts were placed in the mid-descending aorta. Aortic occlusion was made possible either by hypothermia or by arterial shunting. The technic of anastomosis in all instances involved the use of a continuous over-and-over stitch after initial fixation with two or three everting mattress sutures. No. 0000 or No. 00000 Ethicon vascular sutures were used. The grafted segment was irrigated frequently with a dilute solution of heparin in saline. Vascular clamps of several types were used initially, and carefully sprung Glover ductus clamps** were finally adopted for routine use; however, all vascular clamps caused serious damage to

*Manufactured by the Mine Safety Appliance Co., Pittsburgh, Pa.
**Made by Pilling & Sons, Inc., Philadelphia, Pa.

the vessel unless they were properly sprung, and when properly sprung any were satisfactory.

EXPERIMENTS

Group A; Pilot Experiments. Six dogs were used in this phase of the work. Initially, the Rubatex Ivalon porous sponge was prepared by cutting 1- by ¼-inch strips and wrapping them around glass or metal rods spirally, edge to edge. A counterspiral was then added as a second layer. Compression was obtained by loosely wrapping this preparation with ½-inch wide cotton tape. The tubes were then boiled for 20 minutes and stored in 1:1,000 Zephiran Chloride (brand of benzalkonium chloride) solution. This material was placed in the abdominal aorta in three dogs. All three animals died within 2 days. The material was too loosely fused, too porous, easily torn, and thicker than desirable. The tubes were patent in each case.

Rubatex Ivalon compact sponge was prepared in the same manner as above, but with considerably more compression. The tubes were heated in a dry oven at 375°F for 15 to 20 minutes. These tubes were much stronger and thinner, but the porosity was very poor. Although the material was stiff, it sewed and handled well. These tubes were implanted in the abdominal aortas of two dogs. One of these animals died within 12 hours postoperatively of undetermined cause. The second dog was sacrificed 5 days postoperatively because he had developed paralysis of the hindquarters and had no femoral pulsations. The graft was completely occluded with clot. There was no fixation externally. The material was stiffer in the tissues than it had been at the time of implantation.

Rubatex Ivalon porous sponge, prepared as described below for Group B, Lot 1, was implanted in one dog. This material was strong and handled well. The graft was patent at 15 days and grossly appeared satisfactory.

All of these prostheses were 7 mm in internal diameter. One was 1.5 cm long; the rest were 5 to 6.3 cm in length.

Group B; Lot 1 Grafts. These prosthetics were made of ¾- to 1-inch strips of Rubatex Ivalon porous sponge. The strips were wrapped on glass rods spirally, edge to edge, and a second layer was similarly wound in a counter-spiral. The tubes were firmly compressed with an outer wrapping of cotton tape and molded by heating in a dry oven at 275°F. The grafts were stored in 1:1,000 Zephiran Chloride solution.

The prostheses were implanted in the abdominal aorta below the renal arteries in 10 dogs. Five of these animals died at 4, 7, 9, 13, and 26 days postoperatively. In three of these, the cause of death was hemorrhage from the proximal aortic stump.

In one, thrombosis and hindquarter paralysis occurred. In the fifth, wound dehiscence caused the death. Three of these grafts were patent; one was partially clotted and one was completely clotted. The remaining five animals were sacrificed at 7, 9, 16, 48, and 84 days. The grafts were completely obliterated in all five animals.

Four of this group of grafts measured 9 mm in internal diameter; one was 7 mm. One graft was 7½ cm long, and four were 2 to 3½ cm long. The caliber in each instance was matched closely to that of the recipient vessel. The animals in which these grafts were implanted showed necrosis of the aortic stump between the site of occlusive clamping and the anastamosis. This had led to the hemorrhage in the three animals noted above. In grafts that were clotted, injury to the vessel was suspected of being the site of origin of the thrombus. There was no correlation between the caliber or length of the graft and the incidence of clotting. Microscopically, there was poor fixation externally, poor tissue infiltration in the interstices, and a moderate degree of inflammatory reaction about the grafts. The material handled well, was strong, and sutured well, but probably was too dense and somewhat too inelastic.

Group C; Lot 2 Grafts. A slight modification was introduced in the manufacture of this lot of grafts. The same material, Rubatex Ivalon porous sponge, was wrapped as in Lot 1, but was compressed less tightly. The grafts were molded by heating in a dry oven at 260° to 270°F and stored in 1:1,000 Zephiran Chloride solution.

Grafts of this type were implanted in two dogs in the abdominal aorta below the renal arteries. One animal with a 6 cm by 7 mm graft died at 13 days postoperatively with hindquarter paralysis caused by thrombosis. There was poor external fixation. The second animal was sacrificed 73 days postoperatively. The 3 cm by 7 mm graft was patent, had a good pseudointima, better but still incomplete infiltration, somewhat better fixation than with Lot 1, and a moderate degree of inflammatory reaction.

To determine the ideal degree of compression of the Ivalon sponge, the following experiments were carried out:

Blocks of Clay-Adams Ivalon surgical sponge measuring approximately ¼ by ½ by 2½ inches were cut from the uncompressed bricks. These blocks were then placed in small aluminum presses, and compressed so that at one end of the strip the material was reduced to paper thickness and at the other there was no compression. These "wedges" were then implanted subcutaneously in several animals and left in place for periods of 1, 2, 3, 4, and 6 weeks. One half of these wedges had been stored in 1:1,000 Zephiran Chloride solution. The other half

were implanted immediately after boiling. One half of the Zephiran-treated wedges were thoroughly washed in sterile distilled water before implantation. The others were simply wrung out and not washed.

The histologic observations on these implants are described below. The degree of compression best suited to vascular grafts was not found to be determined by tissue infiltration rate or quality but rather by the gross requirements of vascular grafts; that is, porosity compact enough to preclude troublesome oozing and thickness adequate for strength and for manipulation. The most satisfactory tubes were those prepared as in Lot 4, described below.

Group D; Lot 3 Grafts. These grafts were made from Clay-Adams Ivalon surgical sponge. The bricks were thoroughly washed, frozen, and sliced in a meat slicer to 1/8 and 3/16 inch thicknesses. Strips 1¼ inches wide were cut from these. The tubes were constructed of a double counterspiral as above, compressed to about one third of the total thickness, and boiled for 20 minutes in distilled water in an open pan. The grafts were then stored in Zephiran Chloride solution. These prostheses were very good from the standpoint of elasticity, strength, flexibility, and porosity. There was no true fusion of the plastic, but the degree of adhesion made it difficult to separate the layers after boiling.

These grafts were implanted in the abdominal aorta in 15 dogs. Four of these animals died within 1 to 4 days. In two, the cause of death was unexplained. One of these grafts was completely thrombosed in 3 days.

Eleven dogs were sacrificed 20 to 94 days postoperatively. In five, there was complete thrombosis. The grafts were 2½ to 4 cm long. In internal diameter, three were 6 mm and two were 7 mm. Thrombosis was not related to the site at which the aorta had been clamped. In six animals, the grafts were patent and lined by clean pseudointima. These grafts were 2½ to 6 cm in length, and from 6 to 7 mm in internal diameter.

This material handled well, was strong and elastic. It was not quite as porous as was thought desirable.

Group E; Lot 4 Grafts. These prostheses were made of the same material as lot 3.

After thorough washing, the bricks were compressed to 50 per cent of their thickness in a press and boiled for 20 minutes. They were then sliced along the longer edge to a thickness of 1/16 inch. These strips were about 1 inch wide and 8½ inches long. They were wrapped spirally on glass rods, overlapping one half the width, and a second strip was counterwound. This gave a total wall thickness of four layers. This preparation

was then compressed to about one third of its original thickness and boiled for 20 minutes just prior to implantation.

The tubes were implanted in the abdominal aorta below the renal arteries in 14 dogs. Five of these animals died within 24 days. A specimen at 1 day and one at 24 days showed thrombosis. The other three were patent after 6 to 21 days.

Nine animals were sacrificed 32 to 360 days postoperatively. One of these implants was thrombosed after 43 days. This graft was 4.4 cm by 7 mm in size. One graft was partially thrombosed after 7½ months; this graft was 3 cm in length. Seven grafts were patent. One of these was 4.8 cm by 6 mm; the others were 2.5 to 5 cm by 7 mm.

This material handled extremely well, held sutures nicely, was strong, and pulsated perhaps slightly more than the aorta. Grossly, the patent grafts were lined with a clean pseudointima layer. There was good external fixation. There was negligible inflammatory reaction.

Group F; Lot 4 Grafts. In this group, the prostheses, prepared as in group E, were implanted in the descending thoracic aorta in 14 dogs. The animals were operated under hypothermia. Cooling was accomplished by immersion. Rectal temperatures of 73° to 88°F, with an average of 83°F, were attained. Aortic occlusion was carried out for periods of 20 to 50 minutes, with an average of 35 minutes.

Of these 14 dogs, one died the first day of cardiac arrest and nine died after 4 days from atelectasis with empyema. In one of these dogs, the implant was completely thrombosed 4 days postoperatively, while the others were patent and were lined by smooth fibrin, or were clean. One dog died after 26 days; in this case the graft showed a good pseudointima grossly.

The remaining three dogs were sacrificed 330 and 360 days postoperatively. The graft in one dog sacrificed after 360 days was partially thrombosed but not occluded. The other two, at 330 days, were patent and well-lined by a smooth and glistening pseudointima 1 mm or more in thickness. There was good external fixation.

Group G; Lot 4 Grafts. These prostheses, which were prepared as in group E, were implanted into the thoracic aorta in 19 dogs. Aortic occlusion was made possible by the use of a pump bypass. The left brachiocephalic artery and one femoral artery were cannulated. Tygon tubing from the proximal cannula was led through a Sigmamotor Pump and connected to the femoral cannula. The animal was given 1.5 mg of heparin per kg of body weight. After the implantation was completed, the bypass was taken down and the heparin neutralized with an equal dose of protamine sulfate.

This procedure made possible prolonged occlusion of the thoracic aortic in the normothermic dog. By adjusting blood flow through the pump, normal arterial mean pressure could be maintained both proximally and distally. The greatest difficulty in this technic arose from the necessity for using heparin, which caused considerable oozing from the grafts and at the anastomoses.

Nine of the 19 dogs survived the procedure. One died in 2 days from bleeding and atelectasis; one died after a week from undetermined cause; and one died after 10 days from hemorrhage, although the bleeding point could not be located. The causes of death in the 10 that died the first day were technical, relating to the difficulties of cannulation and control of bleeding after operation. The grafts in these animals were all patent, but all were specimens less than 24 hours old. The grafts in those animals which died in from 2 to 10 days also were patent.

Of the six dogs which were long-term survivors, one died after 4 months following hemoptysis of unknown source. Five were sacrificed at 9 to 11 months postoperatively. Grossly, all these grafts appeared to be well-lined with a smooth layer of pseudointima (fig. 1). There was good external fixation. These grafts were 3 to 6 cm in length and 10 mm in internal diameter.

Group H; Lot 4 Grafts (Prosthex). These prostheses were prepared as other Lot 4 grafts, but using Prosthex Ivalon surgical sponge. This material exhibited the same excellent handling properties as the Clay-Adams surgical sponge and sewed well, was strong, and pulsated slightly more than the aorta. It was considered to have the advantage of smaller and more uniform pore size. It molded well boiling in distilled water for 20 minutes.

Five dogs were implanted with tubes from this group. Four died after 2 to 7 days from bleeding and atelectasis. One graft had a small thrombus that originated at a defect in the distal portion of the graft. One dog lived for 2 months and died from unexplained causes. The graft was patent and well-lined. External fixation was good.

HISTOPATHOLOGIC FINDINGS

Wedges. Three wedges prepared as described above, and embedded for 6 weeks in subcutaneous tissue were examined. They were sectioned longitudinally and at three levels in the transverse plane. In all sections, the interstices of the sponge were filled with connective tissue (fig. 2). There was no evidence of progression from the external surface toward the center. Some slight differences among the three wedges were noted. In wedge A, the fibrous tissue was more vascular, with dilated capillary spaces, and appeared to show younger granulation tissue than the other two. In wedge B, the collagen fibers were larger and

less cellular, but there were a few more polymorphonuclear cells scattered about. In wedge C, the collagen was still more dense and mature. In all three, there were many foreign body giant cells. It is thought that perhaps wedge C, which was soaked in Zephiran Chloride solution and not washed, provoked the most violent inflammatory reaction, while wedge A, which was

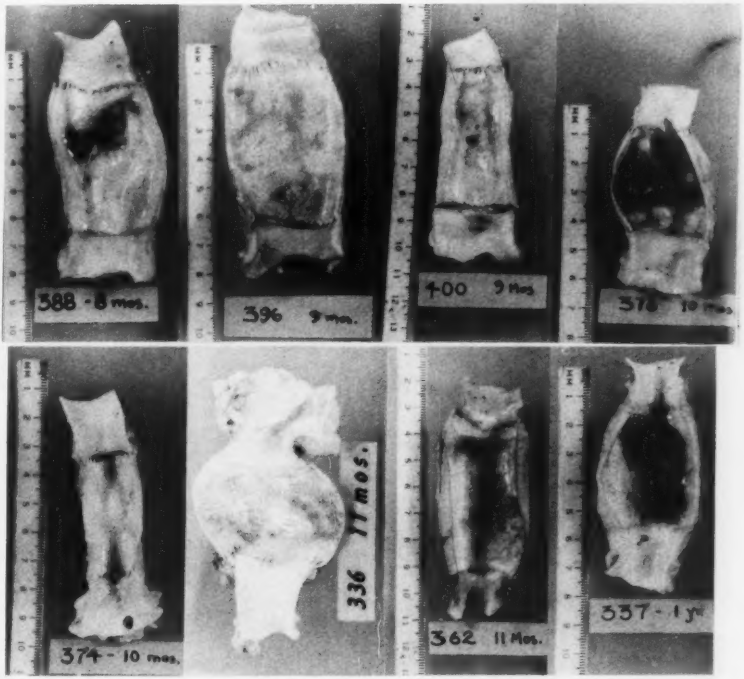

Figure 1. Photographs of eight specimens, all Lot 4. Although some resulted in very satisfactory vascular replacement (No. 396, 400, 374), the disturbing finding of dilatation of the tube (No. 336, 376, 337 and others) and the microscopic demonstration of disintegration of the plastic make this material unreliable. Some specimens show variable degrees of mural thrombosis even as long as one year after implantation.

not treated with Zephiran, provoked the least. This would explain the more rapid proliferation of granulation tissue. Continuing inflammation with the accumulation of neutrophils would hinder the formation of fibrous tissue, but the early stimulation of fibrin-rich exudate would hasten the laying down of fibrous tissue.

Wedges that had been embedded for periods of 1 to 4 weeks also were examined. The 1- and 2-week specimens showed acute

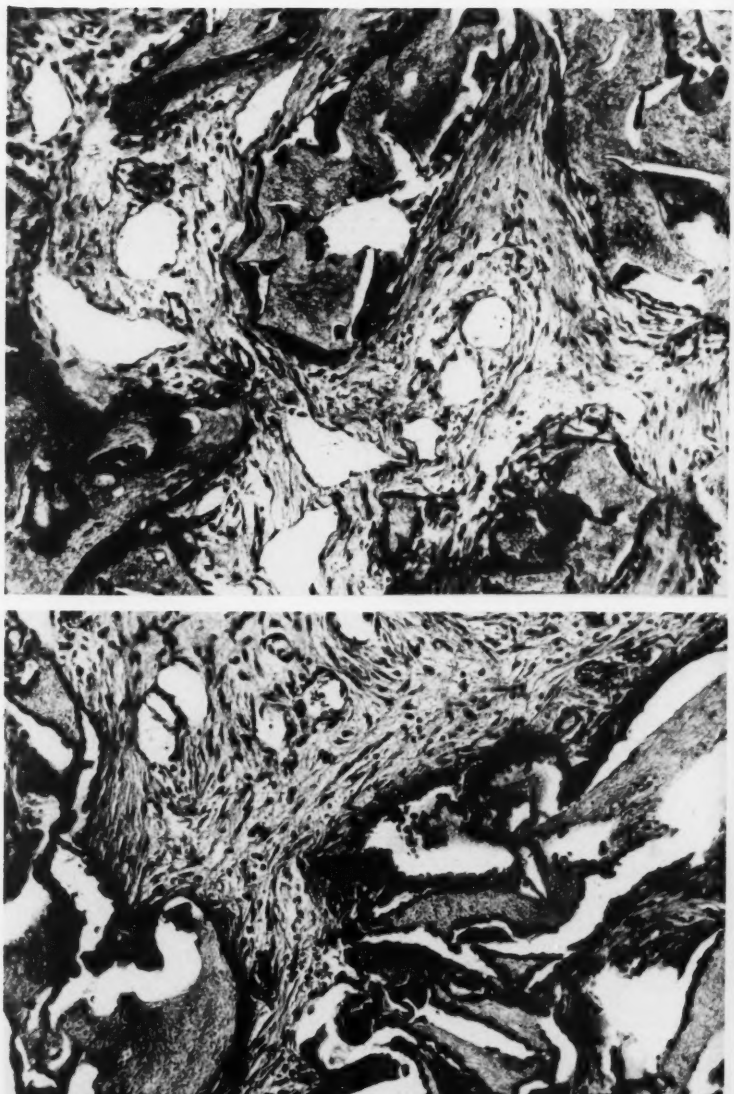

Figure 2. At the top is shown early infiltration of the plastic by vascular connective tissue. The lower frame shows mature connective tissue filling the plastic interstices. Note the dark deposits of "mineral" material.

inflammatory reaction, while the 3-week specimens showed well-developed vascular fibrous tissue in the plastic spaces. Trichrome stain showed collagen fibers and many foreign body giant cells. The 4-week specimens showed increased density of collagen and many giant cells. The change from inflammatory reaction to fibrosis apparently occurs between the second and third weeks (one second-week specimen contained bacterial contamination which obliterated any early fibrous reaction that might have been occurring).

In many of the later specimens, there was a dark granular outline on the periphery of the sponge spicules. This dark material was at first thought to consist of cellular nuclei, but in later observations it was considered that it represented some type of mineral material lining the pores of the sponge. In the latest specimens, it resembled calcification.

Aortic Grafts. The various features observed in the aortic grafts can be grouped under seven headings:

1. *Evaluation of graft compactness.* An attempt was made to evaluate the ratio of Ivalon material to pore space; that is, the compactness of the graft. This proved to be extremely difficult and unreliable due to the inconstant shrinkage of the plastic.

2. *Inflammatory reaction.* The degree of inflammation in connective tissue immediately external to the Ivalon sponge varied considerably. In Lot 1, inflammation was marked even in the 120 day specimen. In Lot 3, there was considerable inflammatory reaction with active granulation tissue at 28 days, but there was no significant inflammation at 60 days and thereafter. In Lot 4, there was only slight reaction after 35 days and none in 42 days. Specimen No. 306 (fig. 1) showed red blood cells and polymorphonuclear leukocytes in the interstices, with no evidence of organization. This material had been implanted for 118 days. Absence of organization may be explained perhaps by the presence of infection. Similarly, specimen No. 400 at 9 months showed a layer of granulation tissue with heavy polymorphic infiltrate along the external surface. No. 337 at 12 months also showed polymorphonuclear cells in most of the plastic spaces within the graft as well as along the external surface. The other specimens showed no inflammatory reaction.

3. *Organization in interstices.* Specimens of Lot 1, even as long as 120 days after implantation, showed no organization. The spaces were filled with fibrin and blood cells. In Lot 3, there was slight organization in the outer spaces at 45 days. Complete organization in the outer one third of the Ivalon sponge was observed, however, at 60 to 75 days in both Lot 3 and Lot 4. It is interesting, however, that Lot 4 specimens showed good organization with mature connective tissue one-half way through

the wall in 27 days and completely through in 35 days. All Lot 4 specimens, except as noted in Section 2 above, showed excellent organization throughout the full thickness of the graft wall.

4. *Fixation to adjacent tissue.* None of the specimens of Lot 1 showed significant degrees of fixation. In Lot 2, one specimen showed some degree of fixation at 75 days, and in Lot 3, a fair degree of fixation was evident at 60 days. Lot 4 showed much earlier fixation with evidence of good anchoring at 35 days and thereafter. In the specimens from thoracic aorta, lung tissue was frequently seen on the external surface with good organization extending into the plastic.

5. *Lumen.* The degree to which pseudointimal proliferation occurs (fig. 3) varies considerably and does not show significant differences among the various lots. In general, at 14 days, the fibrin layer is covered by fusiform cells forming a membrane two to three cells thick. By 20 to 28 days, this layer has thickened and extends approximately 1½ mm from the end of the aorta. At 35 days, it reached 2½ mm; at 45 days, 3 to 4 mm; and at 60 days, 5 mm. This layer at an early stage overlies fibrin and later blends into the fibrin that fills the length of the tube. It consists of both collagen and smooth muscle, with the former occurring in a higher proportion than in the corresponding layers of the neighboring aorta. Although fine elastic fibers were seen in the thickened intima of the adjacent aorta, none were seen in the intima-like tissue within the graft. The major elastic layer of the media stopped abruptly at the cut end of the aorta. In Lot 4, foci of inorganic, presumably calcific, deposits appeared between the pseudointima and the graft at 35 to 40 days. The latest specimens, at 7 to 12 months, frequently showed a continuous intima-like layer lining the luminal surface. This layer varied from one eighth to one quarter of the thickness of the graft wall. In the majority of the specimens, however, this pseudointima was discontinuous and was covered in patchy areas by fibrin. One of the latest specimens at 10 months showed thrombosis. This luminal layer, when finally developed, consisted entirely of collagen, except in one specimen in which trichrome stain showed fibers suggestive of muscle. This could be an artifact of staining. In no case did elastic fibers extend beyond the cut end of the aorta.

6. *Aortic changes.* The changes noted in the aorta, although quite variable, seemed to have no relation to the lot numbers but appeared to depend upon the degrees of trauma inflicted on the vessel ends. In many specimens, hyalin necrosis appeared at the cut ends in from 4 to 6 days. Most of the specimens showed some degree of intimal thickening, one, as early as 6 days. In another, however, there was no thickening at 27 days. In general, thickening was present at 20 to 28 days and

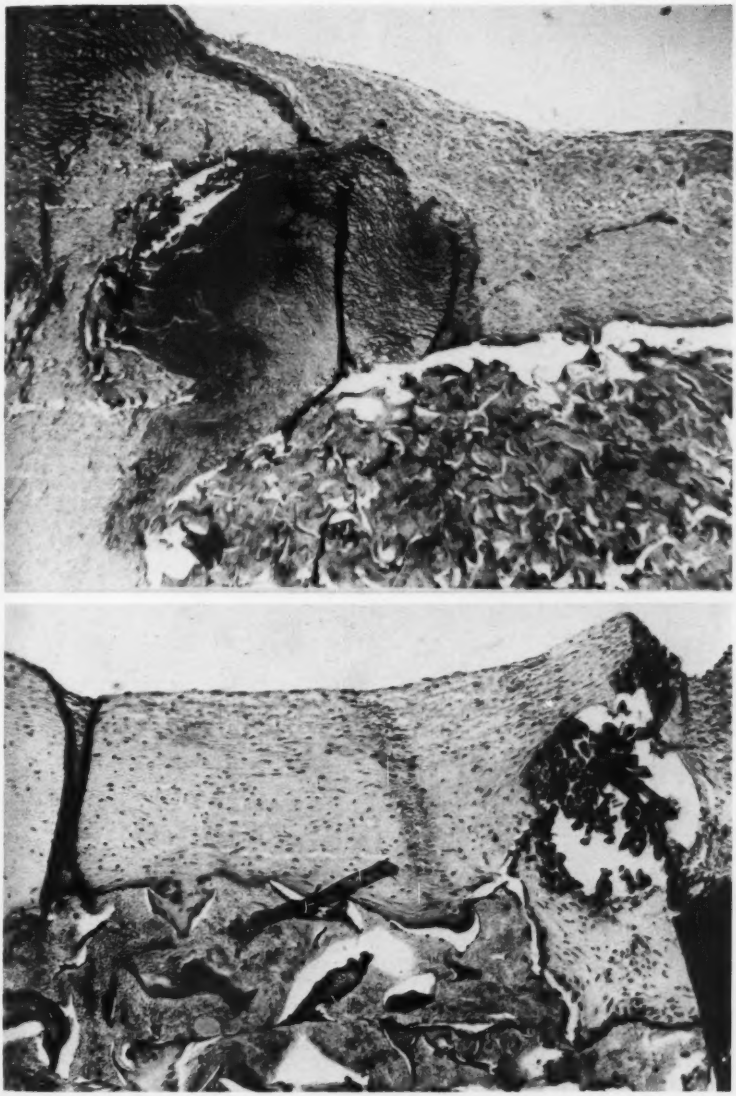

Figure 3. Sections across the junction of plastic to vessel show formation of the pseudointimal layer. The upper photograph shows early ingrowth of fibroblasts into the fibrin layer. Note the abrupt termination of the elastica (upper left corner). The lower illustration shows a pseudointima of mature connective tissue. Note the state of the plastic material at bottom of both frames. The upper specimen is 27 days and the lower 42 days after implantation.

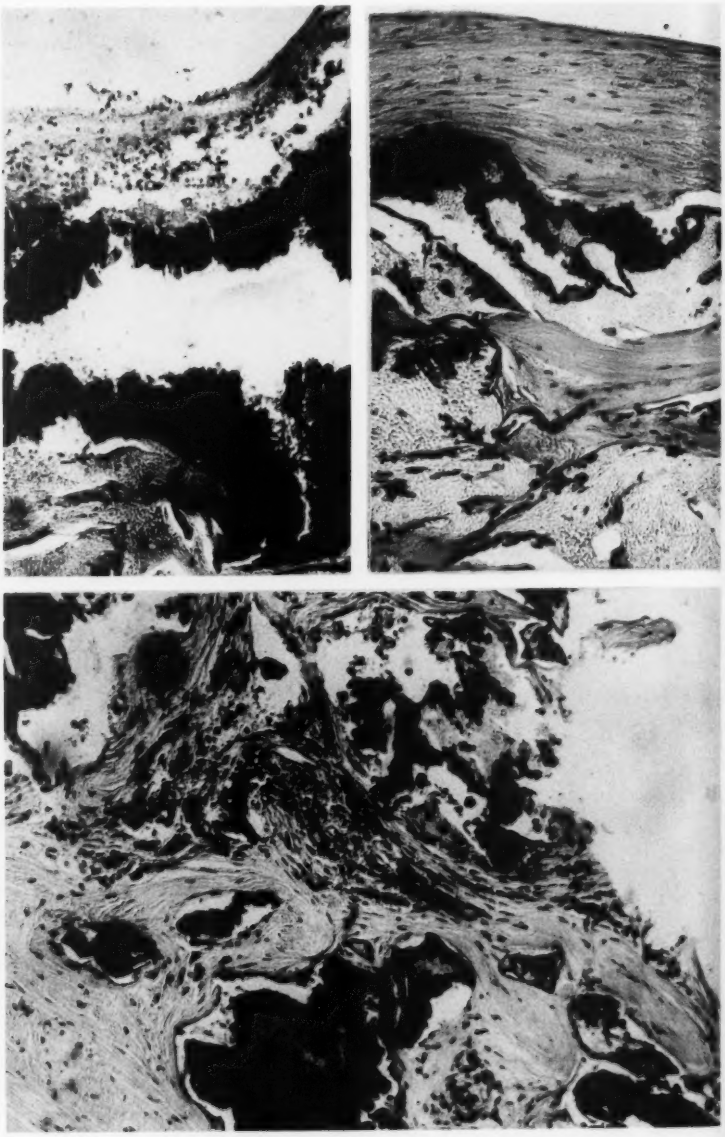

Figure 4. The calcific deposit beneath the luminal layer at 35 days is shown in the left upper illustration. On the right, a well-developed fibrous, external layer is seen, and there is calcific material at the edge of the plastic (8 months). The lower illustration shows extensive disintegration of plastic and replacement with calcific material (11 months).

was marked in the 40- to 45-day specimens. In one specimen, at 120 days, there was extreme thickening, together with calcific deposits in the media near the cut ends. In several specimens, there were focal areas of thickening away from the cut ends, and in one 35-day specimen from Lot 4 there also was some calcium in the media of the aorta. Elastic tissue stains showed that in earlier examples there were no elastic fibers, or at most very fine fibrils running in all directions and possibly representing reticular fibers. In the later specimens, however, there were well-defined elastic fibers oriented longitudinally but not as heavy as the normal elastic tissue of the media. There were two specimens in which a very few fine fibrils appeared to extend from the junction of the aorta and graft for a short distance into the pseudointima. These may represent regenerated elastic fibers.

7. *Changes in the plastic.* The most significant and undesirable changes noted (fig. 4) were as follows. Dark deposits suggestive of calcification first appeared on the edges of the plastic spicules at 6 to 8 weeks. Several specimens showed layers of finely divided calcific material between the plastic and luminal layer at 5 and 6 weeks. Variable amounts of this material were seen in all specimens, until at 8 to 9 months the plastic seemed to be coated by frankly mineral material, in the sense that the investing material had a refractile appearance. At 10 and 11 months, the plastic was undergoing obvious disintegration. This seemed unrelated to inflammatory change, because one specimen at 12 months showed considerable inflammatory reaction but no plastic degeneration. These changes were also unrelated to the lot number of the grafts.

SUMMARY AND CONCLUSIONS

The physical properties of Ivalon (polyvinyl formal sponge) appeared to offer certain advantages not available with other materials for use in replacing vascular segments. To test this, four types of Ivalon sponge were obtained from three different manufacturers and prostheses were prepared by boiling or dry heat, using various technics. These were implanted in mongrel dogs as abdominal or thoracic aortic grafts.

The Rubatex product proved to be unsatisfactory for vascular replacement, not only on the basis of difficulty in fabrication of the tubes but also because it appeared to be less well-tolerated by tissue and less satisfactorily infiltrated by collagen material. It was associated with inflammatory reactions more frequently than were the other two types of Ivalon. The Clay-Adams and Prosthex materials were good from the standpoint of fabrication of the prostheses as well as in regard to tissue tolerance. The most serious limitation to the use of these materials is indicated by late changes seen at 10 months and consisting of extensive disintegration or fragmentation of the graft material. It appears

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that such a process can only lead to eventual disruption of the grafted segment, because fibrous scar tissue alone and unsupported eventually undergoes aneurysmal dilatation.

Technically, tubes of Lots 3 and 4 were satisfactory. Suturing qualities, initial pliability, elasticity, and porosity were excellent. However, gross examination of these implants at a very few weeks showed loss of elasticity, reduction of wall thickness, brittleness and discoloration of the plastic, and sometimes slight reductions of caliber of the tube. In a few late specimens, there was evidence of dilatation of the graft, which correlates with the finding of plastic disintegration described microscopically. The incidence of early clotting or thrombosis was very high in the first lots used in the abdominal aorta. Occlusion by thrombosis in the thoracic implants did not occur, except in the case of one animal that died with empyema a few days after the operation. There were, however, several specimens which showed varying degrees of mural thrombosis.

In one of the pilot experiments, disruption of the spirally wound prosthetic occurred, resulting in fatal hemorrhage. In none of the other animals was there rupture or separation of the plastic material.

The use of the pump shunt during occlusion of the thoracic aorta has many advantages over the use of hypothermia, but the need for using heparin makes hemostasis very difficult, particularly with regard to blood oozing through the pores of the graft. Immersion of the sponge in nonheparinized blood before implantation might be a means of minimizing this disadvantage. This technic should be further evaluated.

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REDUCTION OF IONIZING RADIATION IN DIAGNOSTIC ROENTGENOLOGY

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THE UNITED Nations Scientific Committee on Effects of Atomic Radiation[1] recently expressed its desire to receive information as to the methods and extent by which economy in the medical use of radiation could be achieved, both by avoiding examinations that were not clearly indicated and by decreasing the exposure to radiation during examinations, particularly if the gonads or the fetus during pregnancy lie in the direct beam of radiation. The Committee concluded rather logically: "It appears most important, therefore, that medical irradiations of any form should be restricted to those which are of value and importance, either in investigation or in treatment, so that the irradiation of the population may be minimized without any impairment of the efficient medical use of radiation."[1]

The use of irradiation in industry, engineering, and allied professions has greatly enhanced the possibility for individual exposure, both known and unknown. Young people, particularly, should attempt to learn the type and quantity of the exposure to which they have been subjected, and this should be evaluated before extensive, diagnostic, medical irradiation is contemplated. Each patient requiring therapeutic treatment should be studied minutely. Quimby and Lawrence[2] in 1940 and Henshaw[3] in 1946 have set down rather specific definitions for exposure or dose.

Probably the most publicized and misinterpreted report on the biological effects of atomic radiation is that of the National Academy of Sciences. The section by the Committee on Genetic Effects of Atomic Radiation stated: "First, although the science of genetics is as precise and as advanced as any part of biology, it has in general, and particularly in human genetics, not yet advanced far enough so that it is possible to give at this time precise and definite answers to the questions: just how undesirable, how dangerous are the various levels of radiation; just what unfortunate results would occur? . . . . The scientists cannot say with exact precision just what biological risks are involved in

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various levels and sorts of radiation exposure . . . . When a gene becomes permanently altered, we say it mutates. The gene in its altered form is then duplicated in each subsequent cell division. If the mutant gene is in an ordinary body cell, then it is merely passed along to other body cells; but the mutant gene, under these circumstances, is not passed on to progeny, and the effect of the mutant gene is limited to the person in whom the mutation occurred."[4]

It cannot safely be assumed, however, that the effect is a negligible one on the person in whom the mutation occurred, nor can it be said that this effect is nongenetic, even though passage to offspring is not involved. Various kinds of cellular abnormalities are known to be perpetuated within an individual through body cell divisions, so these effects are genetic in the broad sense.

Individuals bearing harmful mutations are handicapped relative to the rest of the population in that they tend to have fewer children or to die earlier. Hence such genes are eventually eliminated—soon if they do great harm, more slowly if only slightly harmful. A mildly deleterious gene eventually may do just as much total damage as a grossly or abruptly harmful one, because the milder mutant gene persists longer and has a chance to harm more people.

Although many mutations do disturb normal embryonic growth, it is not correct that all or even that most mutations commonly result in monstrosities or freaks. In fact, the commonest mutations are those with the smallest direct effect on any one generation—the slightest detrimentals. The last remark deals with all types of radiation-induced mutations; however, there are others, such as mutations that arise from natural causes. These naturally occurring, and hence unavoidable, mutations are usually called spontaneous mutations. As with radiation-induced mutations, nearly all of the effects of spontaneous mutations are thought to be harmful. It has been stated[4] that about 2 per cent of tangible genetic defects—which include certain mental defects, epilepsy, malfunctions, neuromuscular defects, and many others—are present at birth or appear before sexual maturity. If man-made radiation increases the mutations by a "doubling dose," with an increase from two million defects to four million defects, approximately 200,000 new tangible defects should occur in the first generation.

The total dose of radiation is what counts. This statement is based on the fact that genetic damage done by radiation is cumulative. The geneticists also conclude that mildly larger doses of radiation would produce more but not worse mutants.

The genetic importance to a child is the total radiation dose that the child's parents have received from their conception to the conception of the child. It seems sensible to use a round figure of 30 years in this connection, especially since this figure is the one usually chosen to measure a generation.[4]

Most studies on mutation from exposure to radiation has been done on the genes of the mouse and the fruit fly. Unfortunately, geneticists have assumed that mouse and fruit fly statistics apply reasonably well to man. It seems necessary to emphasize this matter of approximate estimation, so that no one will conclude improperly that a statement is unreliable because it involves a range of values. On the contrary, such a statement, when made in a situation like the present one, should be viewed as all the more dependable precisely because it does not pretend to an unwarranted accuracy. Henshaw, in discussing the radiation-induced mutants in human beings, stated: "With the possibility of irradiation-induced mutations appearing so likely, why are abnormalities not seen more often in the offspring of individuals exposed to radiation? Two possible explanations will be offered here and others will become apparent later. First, irradiation-induced mutations result in changes which are often identical with changes which arise spontaneously, making the detection of abnormalities resulting from exposure to radiation dependent upon statistical evaluations. Some statistical studies have been made but, although a small amount of positive evidence has been obtained, the data are so limited they have little meaning. Second, many mutations are recessive in character and, since the possibility of two similar mutant genes coming together in the same individual is very remote at first, the process of production of such genes must be in operation a long time before recessive characters can be manifested in appreciable numbers."[3]

Many scientists have tried to develop the lowest figure that could be responsibly considered an acceptable dose rate. Various arguments reduced the 5 r to 150 r range and several experienced geneticists have recently made estimates in the narrower range of 30 r to 80 r. The National Academy of Science recommended "that the general public of the United States be protected, by whatever controls may prove necessary, from receiving a total reproductive lifetime dose (conception to age 30) of more than 10 roentgens of man-made radiation to the reproductive cells. Of this reasonable (not harmless, mind you, but reasonable) quota of 10 roentgens over and beyond the inevitable background of radiation from natural causes, we are now using on the average some 3 or 4 roentgens for medical X rays. This is roughly the same as the unavoidable dose received from background radia-

tion."[4] The 10 roentgen recommendation applies in an average sense to the population as a whole.

One should consider the findings of Macht and Lawrence.[5] In 5,461 offspring of radiologists and exposed controls, there were 2.56 per cent twins, 14.03 per cent fetal deaths, and 6.01 per cent congenital defects. In 4,484 offspring of unexposed controls, there were 2.1 per cent twins, 12.22 per cent fetal deaths, and 4.02 per cent congenital defects. Normal offspring constituted 83.23 per cent of the unexposed group, as compared to 80.42 per cent normal offspring of the exposed group. In 328 offspring of radiation-exposed fathers, 348 congenital defects were reported, while 229 congenital defects were reported in 216 offspring who were born of fathers unexposed to radiation. All types of defects were reported. Anomalies of the sense organs occurred with greatest frequency among both the exposed and the unexposed groups, and represented 17.53 per cent and 18.34 per cent, respectively of all anomalies reported. The offspring of exposed persons showed a significantly higher proportion of heart, blood vessel, and blood anomalies than the offspring of unexposed persons. The data given in the Macht and Lawrence report present a picture of first generation effects only. They concluded that the results indicate that small prolonged doses of radiation produce abnormalities in humans.

The problems of radiation protection in diagnostic roentgenology have been discussed carefully by Miller,[6] Henny,[7] and Ritter, Warren, and Pendergrass.[8] Only by studying the relatively specific dosages due to diagnostic procedures, can we develop a program of reduction of total radiation exposure. (We consider roentgen therapy as being a specific mode of therapy, and its additive ionization a medical necessity.) Fluoroscopic dosages usually amount to 10 to 20 r per minute in air, at the point of entry into the patient's body. It is important to note that most of the dosages given are at the skin in air, and do not represent the final dose on the reproductive organs or hematopoietic tissue. For example, in taking an anteroposterior film of the pelvis, 5.3 r at the skin measure only 0.6 r at the ovary. Barium contrast studies are governed by the length of time of exposure. At the other end of the diagnostic range is the usual chest film with only 0.05 r dosage. In securing a gastrointestinal series, the total exposure includes both the fluoroscopy and the film studies. Dental films average about 5 r each. This latter exposure probably means very little genetically, as only 0.005 r reaches the gonads.

Changes in instrument design cannot be controlled at this stage by the average practicing radiologist, and although the

prospect of new developments in roentgenoscopic image amplification should be mentioned, the primary purpose of this report is to discuss specific methods for avoiding exposure to radiation during the usual radiologic examination.

No data covering large numbers of technicians working in radiologic facilities are available; however, the report of Macht and Lawrence[8] points up the fact that the training of radiologic personnel is a cardinal requisite in the reduction of exposure to ionizing radiation. Besides the dogmatic teaching of the principles of radiation, instruction in the use of shielding, coning, positioning, and filters, and in the selection of technics is of great importance. During an exposure, technicians must always move behind a shield. Although distance is a great shielding factor, the habit of specific shielding should not be compromised. Shielding of operating personnel in such procedures as angiocardiography, encephalography, and cardiac catheterization must be adhered to. Good lead aprons will suffice. The use of cones to reduce irradiation other than that essential for the making of roentgenograms is well known. Technicians must be taught to position patients and to utilize correct technics in order to obtain the best possible film at the first exposure. Repetition of exposures cannot be tolerated with our present apparatus, technics, and mechanical aids. Close liaison between the radiologist and his technicians in selection of the correct technics and positions will eliminate multiple exposures. The use of additional filtration such as 1 to 2 mm of aluminum has been well established. Filters should be used in both fluoroscopic and diagnostic machines.

Local shielding of the gonads has been employed in our department with good success. It is well accepted by personnel, readily available, easily accomplished, and detracts only moderately from the diagnostic value of the finished film. It cannot be denied that the male military population can be much more simply protected than can the patients of large city hospitals, in which the sexes examined are more equal in number. Although exposure during an upright anteroposterior examination of the chest is only approximately 0.05 r because of the 72-inch distance, minute amounts of radiation could conceivably affect the gonads. At the present time, a small lead apron made from the usual radiologist's apron is attached at the belt line. This may be of more value in teaching personnel the facts concerning radiation than in actual measurable protection from radiation which according to Chamberlain as reported by Perkins[9] is 0.00025 r to the gonad.

During intravenous pyelographic examination, the testes are shielded quite simply, and this does not detract from the diag-

nostic value of the film. We have been unable to devise adequate protection of the ovaries. Use of the shield as in a pyelographic study is being tried in the low back study, which consists of anteroposterior films, oblique films, and spot films of the lumbosacral space in the lateral view. The male is more readily susceptible to protection in this examination. The number of exposures in the follow-up examination of the small bowel study in children have been decreased. Shielding has not retarded the careful perusual of film made periodically during this examination.

The story of the excited grandmother who phoned the radiologist refusing to submit to roentgen-ray examination because it might affect her grandchildren through her genes is ludicrous, but might serve to highlight several points. One, in patients beyond childbearing age the problem of gonadal exposure is actually no real problem and two, it should be borne in mind that frequently older patients are those who require the most extensive or prolonged studies. We feel that the older patients in the "cancer stage" deserve special diagnostic studies. In a way, the radiation to which this group is exposed falls into the same category as radiotherapy "must have" type of medical procedure.

Attention to the physical factors of technic by the roentgen-ray technician, under the guidance of the radiologist, is another way in which total exposure may be reduced. The changing of high milliamperage to high-kilovoltage and low-milliamperage technics substantially reduces total irradiation without loss of diagnostic value of the films. This is of particular value in children in whom, because of their small size and the desire to see more on one film, large areas are frequently radiated. The use of small fields even in the small child is to be preferred. As mentioned by Henny, the integral dose at 80 kv is 1.4 times as great, and at 50 kv is 5.1 times as great as at 100 kv for the same film density.

Avoidance of any radiographic procedures that might expose the abdomen in early pregnancy should be especially seriously considered. Not only the maternal ovaries but the fetal gonads receive a moderate dose. For example, Sowby[10] found that in pelvimetry the fetus received 26.68 r and the maternal ovary 1.28 r, while in a pyelogram as much as 3.21 r reached the ovary. Actually so little can be learned by doing pelvic measurements early that this procedure should be reserved until the last trimester, when more information may be gained concerning not only the maternal pelvis but also the fetus and placenta.

Production of roentgenograms with reduced exposure by the method of intensification by toning is relatively simple and inex-

pensive, but has not been used advantageously. Intensification may be used when it is necessary to reduce the quantity of the radiation or to use shorter exposure time, or when it is impracticable to use heavy, high-powered apparatus.[11] We are also using this method to render interpretable those films that were technically impossible to study.

The advantageous use of fluoroscopy and the selection of films to be made must be reviewed. In the past, multiple films and spot films "for the record" were made as a backup procedure in many clinics. It is much more important that careful selection of positive as well as negative findings be made and that the number of exposures be reduced. In our present state of enlightenment, the old procedure of taking many films in the hope of finding a diagnosis must be abandoned. Equally as important as selection of technic and reduction in number of films is avoidance of repeating examinations. Technicians particularly, and radiologists also, must avoid the pitfall of having "another look" if the diagnosis is not altogether clear, or of satisfying the human whim of getting perfect pictures on the celluloid. Excellence in technic, not repetition, is the answer to this problem.

Lastly, a few words on education with respect to irradiation. A scare program can be very detrimental to good diagnostic roentgenology. Data from those qualified to speak should be made available and publicized. Early education of technicians and patients is mandatory and acceptable in this atomic era.

Most of the procedures outlined above are practiced daily by competent radiologists and their technicians. Awareness and continuation of good, sound practices that have been used for years by radiologists are probably the only methods for reducing diagnostic irradiation at the present time. A survey of each diagnostic, radiologic department is indicated. Based on the number of exposures of various types, reduction can be concentrated in specific directions. Special effort must be expended toward reducing irradiation in examinations involving exposure of the gonads, primarily studies of the lumbar spine, pelvis, coccyx, hips, and upper femur; and fluoroscopic examinations of the gastrointestinal tract, urinary tract, and reproductive tracts; as well as visualization of the gallbladder, spleen, and liver.

In this small Air Force hospital, roentgen exposure and sites by frequency of occurrence include: chest, hands, feet, ankles, knees, and wrists, in the order listed. The experience in each department may indicate that the problem of reduction of irradiation is not as great as previously considered. Exposure to the gonads is considered inherent in the examination of the lumbar spine, pelvis, coccyx, hips, and femur; in pelvimetry, gastro-

intestinal examination, and examinations of the urinary tract. Actual measurements in our laboratory are not inconsistent with findings at larger teaching institutions, and show that changes in technic to include high kilovoltage and low milliamperage, as well as diminution in the number of films will reduce the total amount of ionizing irradiations to the gonads.

This subject has been of such general interest to the public and the medical profession that, writing in the lay press, Dr. Dwight H. Murray, then President of the American Medical Association, stated: "Control and standardization of the way X-rays are being used in medicine today are in the hands of highly skilled specialists known as radiologists . . . . When X-rays, radium and the radioactive substances, such as isotopes, are used by specially trained doctors of medicine they can be termed 'safe,' although there is some risk in every form of medical or surgical treatment. The hazards of radiation therapy are extremely small, however, in the less serious diseases . . . . They are one of medicine's great gifts both in treatment and cure. In the hands of skilled radiologists, they promise to give you added years of comfort and life."[12]

SUMMARY AND CONCLUSIONS

A review of current scientific and medical pronouncements on the effects of ionizing radiation has been made, and modern radiologic practices have been examined. The following conclusions have been reached: (1) With the knowledge that we already have, we can adequately protect both patients and personnel by the proper use of cones, diaphragms, filters, accurate technic, short exposure time, and the proper use of shielding; (2) medical use of ionizing irradiations for diagnosis and therapy has been well established; (3) alteration of the genes in the gonads by mutation is known to occur and by approximate estimates can be referred to man; (4) total irradiation of patients is cumulative and must be reduced; and (5) from the diagnostic radiologic standpoint, total irradiation may be reduced by a renewed awareness of the best radiologic technic and practices used at the present time.

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SARCOIDOSIS AND PREGNANCY

"In following the course of 10 patients with sarcoidosis through 16 pregnancies, it was observed that pregnancy appears to have an ameliorating effect on sarcoidosis during the prenatal period but that this benefit is frequently lost after delivery. All the patients tolerated pregnancy well; however, there were two abnormalities of pregnancy and three fetal abnormalities noted in the 16 pregnancies. The observed improvement of the sarcoidosis during pregnancy might constitute evidence against tuberculosis being the etiology of sarcoidosis, since pregnancy does not improve, and may even aggravate, tuberculosis. It is possible that improvement of sarcoidosis during pregnancy is due to the increase in production of corticoids by the adrenal glands during gestation."

—ROBERT L. MAYOCK, M. D.,
ROBERT D. SULLIVAN, M. D.,
ROY R. GREENING, M. D.,
RALPH JONES, Jr., M. D.
in *Journal of the American Medical Association*
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Clinicopathologic Conference

William Beaumont Army Hospital, Fort Bliss, Tex.*

HEADACHE AND INTERMITTENT PARESIS

Summary of Clinical History. A 45-year-old white woman had a sudden onset of sharp, severe, throbbing, right temporal headache on the morning of admission to this hospital. The headache remained severe, was made worse by any movement, and was not particularly relieved by anything, including aspirin. Shortly before admission she began noting slurring of speech and equal weakness of the left arm and left leg, causing unsteadiness of gait. She did not lose consciousness. There had been no previous paresis, syncope, anesthesia, or memory loss.

The patient had pneumonia in 1950, possibly associated with pleural fluid, and followed by a chronic cough productive of dark, thick material, but without hemoptysis. The patient was known to have hypertension since 1949. She also had had exertional dyspnea and ankle edema for the past year and a half. The patient had been unconscious for a very brief interval following an automobile accident in 1948; she was released from a hospital in a few days.

Physical Examination. The patient was a well-developed, fairly well-nourished, white woman, who was somewhat lethargic, had slight dysarthria, and complained of severe right temporal head-

*At the time of this conference, Col. Abner Zehm, MC, USA, was Commanding Officer. From the Laboratory Service, Maj. John A. Fust, MC, USA, Chief. Dr. Fust is now at Hamot Hospital, Erie, Pa.

ache. Her pulse rate was 84 per minute and her blood pressure, 184/110 mm Hg. The optic disks were normal. The fundic arterioles were spastic with a 4:1 venous-arteriole ratio. No hemorrhages or exudates were noted. The teeth were partially absent and the gums appeared unhealthy. The tongue deviated to the left and a gag reflex was present. The breasts were normal. The lungs were slightly hyperresonant to percussion and had coarse rales throughout. Examination of the posterior chest was unsatisfactory because the patient was in decubitus position. The point of maximal cardiac impact was palpable and visible 10 cm from the midsternal line in the sixth intercostal space. The mitral first sound was widely split. The liver was palpable two to three fingersbreadth below the right costal margin. There were no abdominal masses or tenderness. A lower abdominal scar was well healed. Neuromuscular reflex reactions were: right biceps 2 plus, left 3 plus; right triceps 2 plus, left 3 plus; right knee jerk 2 plus, left 3 plus; right and left ankle jerk, 0; absent Babinski bilaterally; and Gordon and Oppenheim both 1 plus bilaterally. There was left facial paralysis, and weakness and flaccidity of the left arm and leg.

Laboratory Studies. The urine had a neutral reaction and normal albumin and sugar. Microscopic examination of the urine disclosed many epithelial cells, 3 to 5 white blood cells, and an occasional red blood cell per high-power field. White blood cell count was 10,200/μl, with 71 per cent neutrophils (6 per cent band forms), 22 per cent lymphocytes, and 7 per cent monocytes. The red blood cells numbered 4,680,000/μl and the hemoglobin was 13.2 grams/100 ml. The spinal fluid three days after admission was clear with a cell count of 237 white blood cells/μl (10 per cent neutrophils and 90 per cent lymphocytes), total protein of 100 mg/100 ml, colloidal gold 1112333110, and the serologic test for syphilis was negative. A blood cardiolipin test was negative. Six days after admission the spinal fluid was clear with a white blood cell count of 45/μl; sugar, 55 mg/100 ml; total protein, 72 mg/100 ml; colloidal gold, 0001220000; and chlorides, 729 mg/100 ml.

A roentgenogram of the chest disclosed normal lung fields. The bones of the skull were normal on a roentgenogram. A calcified pineal was in normal position. A deep Q wave in lead III of an electrocardiogram was probably positional, in absence of a significant Q wave in lead aVF. A slightly prolonged Q-T interval suggested myocardial disease or uremia.

Course in Hospital. The morning after admission the patient had involuntary urination and defecation, but had called for a bedpan. Her left arm and left leg gradually increased in strength.

The headaches gradually decreased in severity and she became more alert, so that upon discharge she was able to walk and could talk intelligently. There was, however, a residual headache. She was given a rice diet and the blood pressure dropped; at the time of discharge it was 110/70 mm Hg. The trend of the findings on spinal fluid examination indicated a vascular disorder. She was instructed to remain on the rice diet and take 30 mg of phenobarbital four times daily; 90 mg of papaverine three times daily; and a multivitamin preparation once daily.

Fifteen days after this first admission the patient was seen in the receiving office. It was obvious that she was no better than she had been previously. Neurologic examination failed to reveal any progression of signs. The pupils were extremely small and it was believed that the patient might have been taking heavy medication for her severe headache. She was admitted for a detailed neurologic study. On this admission, the patient stated that her mother had died with a similar paralysis. That evening, the patient was able to walk with support. The next morning she was very lethargic and unable to converse intelligently. Her blood pressure was 210/100 mm Hg and her pulse, 72 per minute. There was Cheyne-Stokes respiration and she was incontinent. The neurologic examination had changed in that the right pupil was widely dilated and the patient had vomited. A blood bromide level on this second day was 15 mg/100 ml. The patient died quietly the day after admission.

DISCUSSION

Doctor Schaerer:* This 45-year-old white female patient was admitted with a history and a clinical picture that would immediately suggest a diagnosis of a stroke. Her past history shows that she had pneumonia in June 1950 from which she recovered. Furthermore the patient had been a known hypertensive since 1949. During the past year and a half she had exertional dyspnea and ankle edema which, together with the fact that her liver and heart were moderately enlarged, would seem to suggest early congestive heart failure. The terms *apoplexy, CVA,* and *stroke* are used interchangeably in describing a picture such as the one presented by this patient. These terms merely imply that something of sudden nature has happened in the patient's central nervous system, causing him or her to be paralyzed. The term *CVA* indicates that this "something" was accidental in nature, which in most cases is incorrect. *CVA* is an ugly abbreviation which should be dropped from our vocabulary. All of these terms tend to lull the physician into a state of mind where he assumes to have established a satisfactory diagnosis usually resulting in therapeutic nihilism of prescribing vitamins and some

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vasodilating drugs of questionable value. One should keep in mind that many conditions may give rise to similar neurologic syndromes and that the neurologic signs and symptoms merely tell where the lesion is but not what the lesion is due to.

The differentiation of the *cause* of the clinical picture has become more important in recent years since depending on the exact underlying process different measures will have to be instituted. Sudden onset of severe throbbing headache followed within a matter of hours by symptoms of paralysis almost certainly indicates vascular disease. We now shall consider the differential diagnosis of cerebral vascular disease with major neurologic symptoms. Differential diagnosis as to pathogenesis is fairly simple, but the etiologic possibilities are myriad. Disturbances in circulation are by far the most common of all the organic cerebral diseases. Spontaneous cerebral vascular lesions rank third or fourth among the causes of death in the United States. The pathogenic mechanisms involved can be reduced to four main ones: first, thrombosis; second, hemorrhage; third, embolism; and fourth, so-called vasogenic encephalopathy characterized by histologic findings of ischemic damage to the brain tissue without obvious occlusion of any large blood vessels.

The clinical pictures presented by these mechanisms are very similar. The difference is more a quantitative than a qualitative one. The most common of the four mechanisms is thrombosis followed by hemorrhage, and embolism the least frequent. Vasogenic encephalopathy is probably more common than usually realized and may be even more common than thrombosis. Most valuable information as to type of lesion is to be obtained from an accurate history. Prodromal symptoms, for instance, may be absent in embolism. In thrombosis and hemorrhage they are very similar. Both categories may produce headache, dizziness, and paresthesias.

In thrombosis chronic personality changes may be more common than in hemorrhage, whereas in the latter, vomiting, convulsions, loss of sphincter tone, and loss of consciousness are frequently encountered at the time of actual hemorrhage. Thrombosis in the absence of prodromal symptoms with a sudden dramatic onset may simulate hemorrhage. One would expect vasogenic encephalopathy to produce the mildest picture of the three, but again cases have gone on to actual death without any histologic evidence of thrombosis but with the picture of diffuse ischemia of the brain. The most common causes of thrombosis are arteriosclerosis, syphilis, arteritis obliterans, periarteritis nodosa, polycythemia, sickle cell anemia, leukemia, and shock. The resulting tissue damage is characterized by softening and edema of the brain tissue, at times simulating the picture of a tumor. Thrombosis is seen somewhat more frequently in males than in females and occurs most commonly during the fifth and sixth decades. Hemorrhage and hypertension, with or without arteriosclerosis, is often seen.

Vascular disease without hypertension, and trauma, aneurysm, vascular tumors, and blood dyscrasias must be considered; particularly if faced with a young individual aneurysm is a serious consideration. At times it may be almost impossible to decide whether one is dealing with a hemorrhage into an infarcted area or with a primary hemorrhage. In hemorrhage the initial lesion may be intimal hemorrhage into the cerebral vessel wall similar to those seen in coronary vessels. A distant perivascular extravasation in the pons and medulla probably is merely a reflection of the suddenness and violence with which the pathologic event causes a sudden increase in intracranial pressure followed by temporal lobe herniation and possibly a cerebellar herniation.

Vasogenic encephalopathy is commonly seen in patients with either hypertensive arteriosclerosis or renal disease. It is thought that the ischemic changes found are the result of vascular spasms or the result of sudden drops in blood pressure, as for instance in patients with myocardial infarction or patients in severe shock. Angiographic studies in patients with aneurysms have demonstrated vascular spasm to occur commonly in blood vessel receiving the aneurysm. Focal signs in patients with subarachnoid hemorrhage due to ruptured aneurysm may be due to hemorrhage into cerebral tissue or, and probably more common, due to spasm in the neighboring arteries. In cases where such vasospasm leads to permanent functional loss one would have to assume that a protective mechanism has overshot its goal.

Sudden cerebral symptoms which tend to improve also occur in the following conditions which have to be considered in the differential diagnosis. (1) Subdural and extradural hematomas, in the absence of a traumatic history would not be very high on the list, although chronic subdural hematoma may occur without history of trauma. These patients usually present histories of chronic headache. Their condition shows fluctuation, and actual neurologic changes occur more or less gradually. (2) A malignant infiltratively growing brain tumor may exist for considerable time without causing any symptoms. Sudden hemorrhage into the tumor tissue may simulate a mere brain hemorrhage. Some of these tumors are also known to have a tendency to cause thrombosis. The main feature of thrombosis or hemorrhage with brain tumor would be progression of disease rather than a tendency to improve following the initial attack. The possibility of brain tumor would have to be seriously considered in our case. (3) Brain abscess has a tendency to simulate brain tumor. Not infrequently the patient shows evidence of a focus of infection such as bronchiectasis; however, brain abscess if well encapsulated may not cause a febrile picture. Changes in the spinal fluid such as marked pleocytosis are commonly seen; the blood picture most commonly shows a definite increase of the white cell count, as seen with abscesses elsewhere in the body. (4) Postconvulsive paralysis usually does not present any diagnostic difficulties in

the face of an epileptic history. (5) Multiple sclerosis rarely may simulate an apoplectic attack. (6) Adams-Stokes syndrome. (7) Carotid sinus syncope. (8) Extracranial carotid thrombosis. This last condition definitely enters into differential diagnoses. The symptoms produced by it are very protean and range from almost nothing to severe mental deterioration, the typical picture being a hemiparesis with unilateral blindness, the clinical picture depending entirely on the possibilities of collateral circulation in a given case. (9) In a comatose patient diabetic, uremic, and hypoglycemic coma must be considered. (10) Poisonings, particularly lead poisoning, may lead to vascular disease and hypertension, which in turn may cause one of the mechanisms previously discussed.

In addition to the history and physical and neurologic examinations, it may become necessary to have blood and urine, blood chemistry, cerebrospinal fluid, electroencephalographic, angiographic, and air studies in order to pin a certain cause to any given clinical picture. We may now examine our protocol as to possible clues to the cause, but we are not very richly rewarded. There is hardly any doubt that the underlying mechanism is a vascular one and as far as mechanism is concerned we will have to consider thrombosis, hemorrhage, and vasogenic encephalopathy. Since there is no obvious source of embolism I think we can rule this out. Thrombosis, hemorrhage, and hemorrhage into a brain tumor are all good possibilities. The absence of a bloody spinal fluid is more in favor of thrombosis. The fact that the calcified pineal is in a normal position makes the presence of a brain tumor rather unlikely, although a brain tumor of infiltrative type may not cause a shift of the pineal.

The laboratory data show some spinal fluid abnormalities which demonstrate a tendency to clear up between the third and sixth day of the first hospitalization and are such as very well may be seen with ischemia to brain tissue. They do not seem to be diagnostic. The neurologic examination merely indicates that the right hemisphere is involved. The neurologic picture presented is not characteristic of occlusion of any particular intracerebral artery. The patient was a known hypertensive and as such was predisposed to either thrombosis or hemorrhage. The possibility that this patient may have had an aneurysm that at first merely caused vascular spasm and finally ruptured also has to be considered. Syphilis as a possible cause of thrombosis may be ruled out in the absence of positive serologic reaction and a colloidal gold curve which in the spinal fluid obtained on the third day of hospitalization showed a mildly parenchymatous type of curve and within three days went back to normal without any specific therapy. The patient died in a manner indicating sudden increase of intracranial pressure in the right hemisphere, respiratory failure, temporal lobe herniation, and possible cerebellar herniation. Again, this could be the result of massive thrombosis or hemorrhage.

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On the basis of information contained in this protocol we can merely state that this patient died of a sudden increase of pressure in the right hemisphere, most likely as a result of massive edema, secondary to ischemia produced by vascular occlusion.

Dr. Schaerer's diagnosis:
Cerebral vascular occlusion of undetermined origin

Doctor Lopez:* I noticed in the cerebrospinal fluid findings that the chlorides were at least in the upper limits of normal and the sugar low. That, together with 90 per cent lymphocytes, causes me to think that it is due to syphilis or tuberculosis. A tuberculoma is possible.

Doctor Leland:** I think everything points to syphilis except the cerebrospinal fluid. Serology was negative but I do wish to call attention to the fact that a gold curve high in the middle is known as a luetic curve in the old classification.

PATHOLOGIC FINDINGS

Doctor Fust: I would like to thank Major Schaerer for trying to make a silk purse out of a sow's ear. We are all perfectly aware that it is difficult if not impossible to put a finger on the precise cause of death in this patient. I think only one who has seen such a case would be able to include it in a differential diagnosis, and even then not with any great degree of certainty. Aside from severe pulmonary congestion and edema, and the little bit of atherosclerosis that was generalized, the significant findings were in the brain. The gyri and sulci of the right cerebral hemisphere were found to be a little more flattened than those on the other side. You can see in the area of the internal capsule (fig. 1) this large defect made up mainly of abscesses which range in diameter from 0.5 to 3.0 cm.

Cavitation occurs somewhat posterior to the area you have just seen (fig. 2). The abscesses contained grayish brown or bright yellow, necrotic material. Microscopically, a polymorphonuclear leukocytic reaction is seen at the centers of the necrosis. Somewhat peripheral to this are areas of chronic inflammation mainly centered around small blood vessels. There are giant cells in the pus, usually near or around nonseptate hyphae (fig. 3A). When we say nonseptate we mean that you can look along this tube (fig. 3B) and see no divisions. This is a characteristic of the family Mucoraceae which is made up of several genera including mucor and rhizopus, both of which are thought to cause disease in man, probably with recently increasing frequency. We cannot distinguish between rhizopus and mucor in the tissue but we can culturally. Mucormycosis as a disease of man usually involves the lungs or central nervous system. Some of the cases appear to have been caused by species of mucor, others by species of rhizopus. We

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**Col. Louis S. Leland, MC, USA, Chief, Dermatology Service.

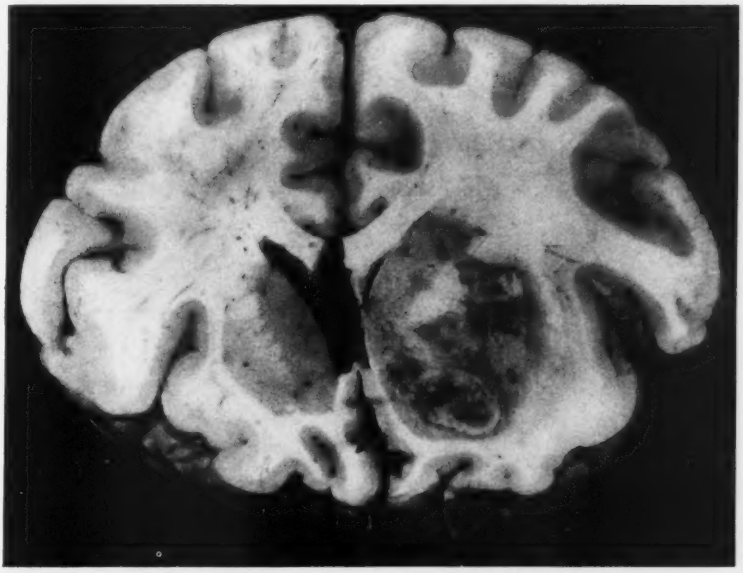

Figure 1. Abscesses in the right cerebral hemisphere.

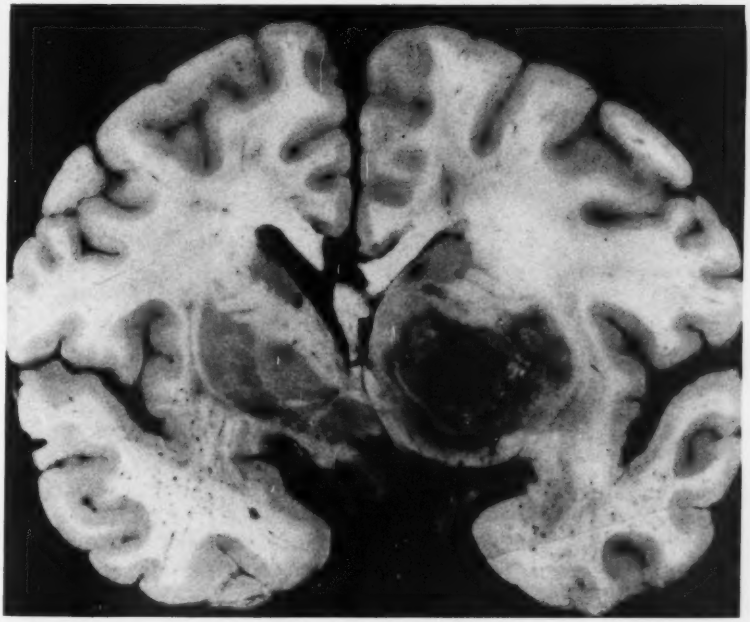

Figure 2. Cavitation in the cerebral abscess.

may call the disease mucormycosis in either event because of the familial name.

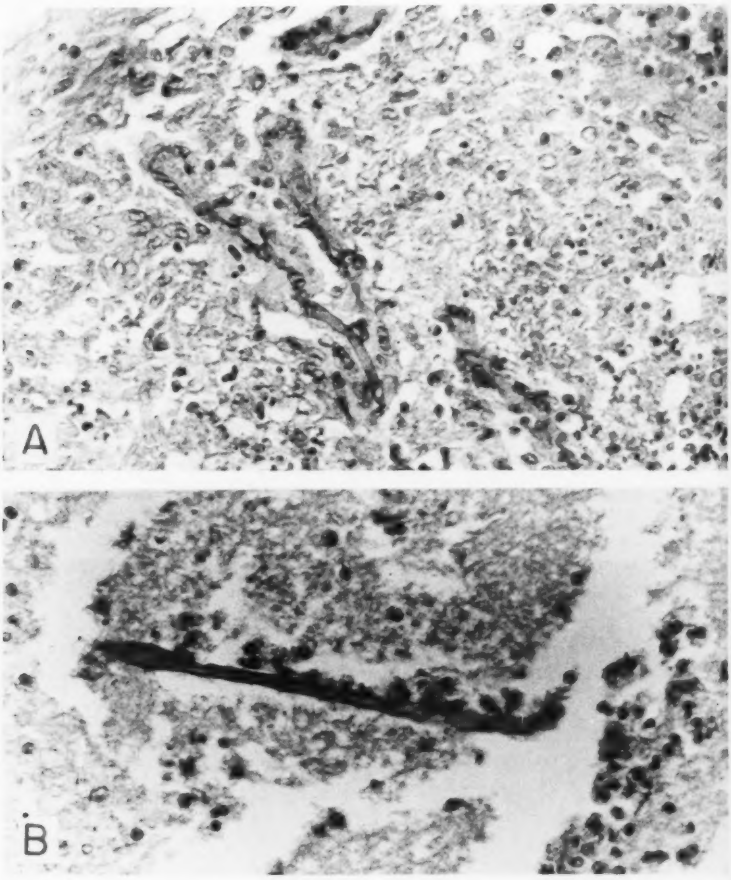

Figure 3. (A) *Multinucleated giant cells engulfing fungi.* (× 400) (B) *Nonseptate Mucoraceae.* (× 600)

Bauer and associates[1] described 2 cases of mucormycosis and collected 9 others. Of these, 6 certainly had diabetes, 1 had hemochromatosis, and 1 was a possible diabetic. There is a triad of symptoms in the majority of cases but, as is true of most clinicopathologic conferences, not in this case. The triad includes ophthalmoplegia, evidence of meningoencephalitis, and diabetes mellitus. Bauer and associates thought that the sinuses are the point of entry in cerebral cases. The organisms are sometimes called "sugar fungi" because of their ability to break down carbohydrates, and Garrett[2] was quoted as saying

growth of this fungus is accelerated as soon as a suitable substrate is at hand. This may account for the association of these fungi with diabetes mellitus. Baker[3] described patients with pulmonary mucormycosis who had received antileukemic drugs, such as antifolics and

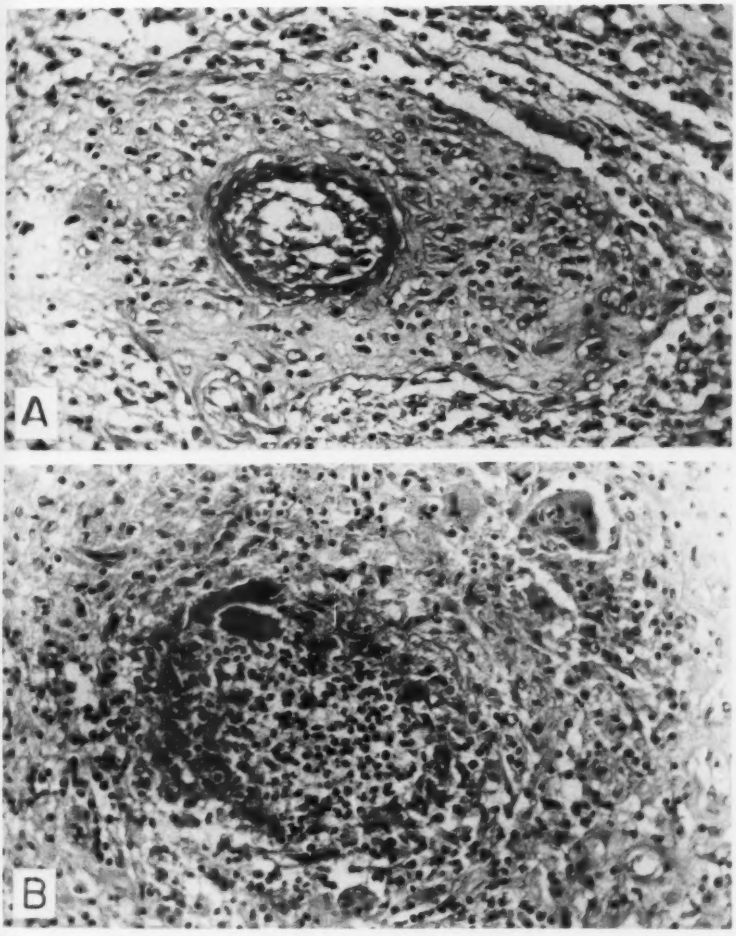

Figure 4. (A) *Arterial mural thickening, probably due to fungus infiltration.* (× 300) (B) *Septic thromboarteritis with giant cells.* (× 300)

steroids, and who also were given antibiotics for prolonged periods. He thinks that the increased use of the latter may induce instances of complication by fungi that otherwise would have been due to bacteria. In his patients inhalation of spores with subsequent proliferation and invasion of the bronchial walls and pulmonary vessels were commonly seen.

The fungi have the peculiar ability to invade apparently healthy arteries with subsequent arteritis and thrombosis. The most significant pulmonary lesion is actually infarction due to thromboarteritis. There is no mention of it in the protocol of this autopsy but many of the cranial cases have had extensive thrombosis of internal carotid arteries in addition to the smaller areas of arteritis within the brain. This is in keeping with Major Schaerer's idea that thrombosis with subsequent cerebral edema occurred in this case. Figure 4A shows such an inflamed artery with thickened wall and incipient thrombus. I cannot see any organisms here but chances are that with other stains they would be apparent in the arterial wall.

Figure 4B demonstrates a vessel in which there is a giant cell that almost surely indicates that there are organisms within this vessel. The fact that only a few such cases have been reported does not mean that this is as uncommon. I have seen two unreported cases and there have probably been many unrecognized ones. There will be more. If you want to remember the classical case, think of someone with ophthalmoplegia, diabetes mellitus, and symptoms of meningoencephalitis. You cannot do much for him. You can give him iodides and treat his diabetes. Those who have the cerebral form of the disease die. Apparently others who have had diabetes and the pulmonary form of the disease have recovered with control of the diabetes.

Pathologic diagnosis:
Cerebral mucormycosis

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SERVICE ARTICLES

ACCURACY OF PREDICTION OF MILITARY SUCCESS OR FAILURE

A Follow-Up Study

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ISAIAH M. ZIMMERMAN, *First Lieutenant, USAF (MSC)*

MANPOWER IS a word that has become significant for most Americans. In this technological age, manpower, particularly skilled manpower, is one of our most important national resources. Social or economic planning today requires an assessment not only of time, money, natural resources, but also of the "human factors." The armed services, which even in peacetime constitute one of our large industries, have the continuing task of recruiting, training, and utilizing great numbers of men and women in a wide variety of jobs. The United States Air Force, in this age of jet aircraft, guided missiles, and nuclear warfare, has an unusually large demand for skilled manpower.

Each generation has had its own selection technics for choosing men for its specific tasks. The expansion in industrial activity which began with World War II has created a demand for increasingly precise selection procedures. In the past, selection often depended on such factors as trade or guild affiliation, social status, or physical prowess. The industrial complex of today requires many technicians to manage its controls. A keen analysis of the skills of each potential recruit is needed. Waste in terms of maladaptation to the job is increasingly costly. Vast sums are spent on recruiting.

Various devices have been used in recent years to select manpower. Screening efforts probably reached their peak during world War II when as many as 40 per cent[1,2] of the potential inductees for the armed services were declared unsuitable for psychiatric or psychologic reasons. The project to be discussed in this article is an evaluation of one of the familiar manpower screening procedures.

Presented on 16 May 1957 at the meeting of the American Psychiatric Association in Chicago, Ill.

From Office of The Surgeon General, Department of the Air Force, Washington 25, D. C.

The rapid rebuild-up of the Air Force which began with the Korean hostilities revived an urgent requirement for the screening and selection of large numbers of men for combat and combat support. This need appeared to be more critical than during World War II, because of the technological advances that had occurred in the interim. Although much had been written about screening during the years of World War II, there appeared to be no clear-cut answers as to the effectiveness of previous efforts. For that reason the evaluation project to be described in this article was undertaken.

SCREENING OPERATION

During the period under study the typical Air Force recruit was subjected to an analysis as follows:

He was examined physically and given an enlistment screening test designed to evaluate his learning ability. He was queried as to a possible criminal record. The Armed Forces Qualification Test (AFQT) was administered to estimate his intelligence and adaptability level. At the basic training center a second supplementary physical examination was performed, and he was also tested with a job aptitude battery. During this "processing" there was no formal psychiatric evaluation except that which might have occurred during the physical examination if the suspicions of the examiner were aroused by the recruit's behavior or statements.

In 1953 a new, two-step operation was inserted into the training program in order to fill the need for an evaluation process designed for prediction of psychologic suitability.

The first step was a paper and pencil personal history test containing some 30 "open-end" queries as to personal interests and dislikes, forced-choice questions, and phrases requiring completion. Certain of these items were "weighted" as to their diagnostic "clue" value. If the recruit responded to four or more of these "suspicious" items, he was referred to the Mental Hygiene Consultation Unit for a psychiatric evaluation.

The Mental Hygiene Consultation Unit served as the second step of this screening operation. The Unit was situated in a building within the basic training area. It was staffed by psychiatrists, social workers, and psychologists. Recruits referred through the medium of the personal history questionnaire received standard psychiatric work-ups, including interviews with the psychiatric social worker, projective tests, and one or more interviews with a psychiatrist. This second phase of the operation was necessarily limited in time by the 11-week basic training period.

At some point during evaluation, the Consultation Unit psychiatrist assigned an "S" profile number to the trainee under the Armed Forces physical profiling system, commonly referred to as "PUIILES." The S category refers to the psychiatric profile. Designation of an S-1 or S-2 amounted to a prediction that the recruit would remain psychiatrically fit for military duty. An S-3 or S-4 profile indicated that as the result of both steps of this screening operation, a recruit was considered to have a personality disorder which would be likely to incapacitate him for effective performance of military duties.

ASSUMPTIONS

It was assumed, from common experience, that a certain percentage of airmen would fail to meet the standards of performance required of them. Experience had also shown that most of the failures in performance usually manifest themselves in the initial phase of training. A certain number of recruits were definitely disqualified and destined for discharge. Another group was fully qualified and likely to succeed, success being defined as retention in the service during the period of study, which in most cases was about six months. A third group was assumed to exist which was "probably qualified" for success under the same standard. The latter borderline group was regarded as capable of succeeding if given brief supportive psychotherapy. All three groups were presumed to be identifiable by means of the two-phase screening effort, *i. e.*, the personal history report and the Consultation Unit psychiatric evaluation. Each man was labeled a 1, 2, 3, or 4 under the S of the profile system.

METHODOLOGY

The setting for the study was a large Air Force basic military training center. For the purpose of this study the first 341 airmen who were given the profile S-3 or S-4 as a result of the two-step psychiatric evaluation constituted the project group. The label of an S-3 or S-4 profile indicated that these airmen were expected to fail in military service because of psychologic unsuitability. To evaluate these predictions, each one of these men was "tagged" and followed for the next several months.

A control group of individuals labeled S-1 was selected and matched to the project group. This matching included the selection of a "running mate" for each projectee from the same training group, from a similar geographic area, and of the same relative level of intelligence. The military history of each member of the two groups was investigated. Every airman was followed for the purposes of this study for at least four months. Some earmarked early in the study were followed for nine months. Thus, each airman in the two groups was observed within these vary-

ing periods of time after completion of basic training. His commander was queried as to whether the subject had remained on duty and, if not, what disposition had been made. If he had remained on duty, a statement about his effectiveness was requested. The commanders queried were told that the evaluation was merely a routine spot check on the careers of a random sample of airmen. No reference was made to the S profile.

It should be noted that the majority of the project group was composed of individuals with character disorders, hence their disposition was the responsibility of the line commanders and they were not handled by medical disposition. The commander could, and often did, disregard the predictions of the psychiatrist. Frequently the man had to demonstrate his disorder by noneffectiveness or by antisocial behavior before any action was taken. This in part accounts for the varying periods of time during which the predicted failures "survived" on active duty. Throughout the study an attempt was made to insulate psychiatric prediction from disposition decision.

FINDINGS

In the project group (fig. 1), 154 men (45.1 per cent) were discharged at the basic training center or at the next base, were absent without leave (AWOL), or confined at the time of the study.

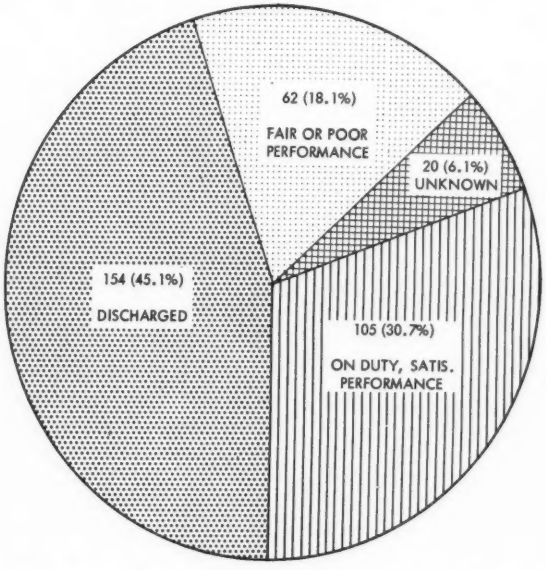


Figure 1. Performance and duty status of the project group (with S-3, S-4 labels) of 341 airmen.

In addition, 62 men (18.1 per cent) were rated as fair or poor performers by their commanders at their permanent duty stations. Thus, 63.2 per cent of the project group could be labeled failures or potential failures. Only 105 men (30.7 per cent) remained on duty and were rated as satisfactory by their commanders. The fate of 20 men (6.1 per cent) is unknown. Contrast these findings with the control group (fig. 2). In the control group, 30 men (8.7 per cent) were discharged, or AWOL, or confined. Sixty-three

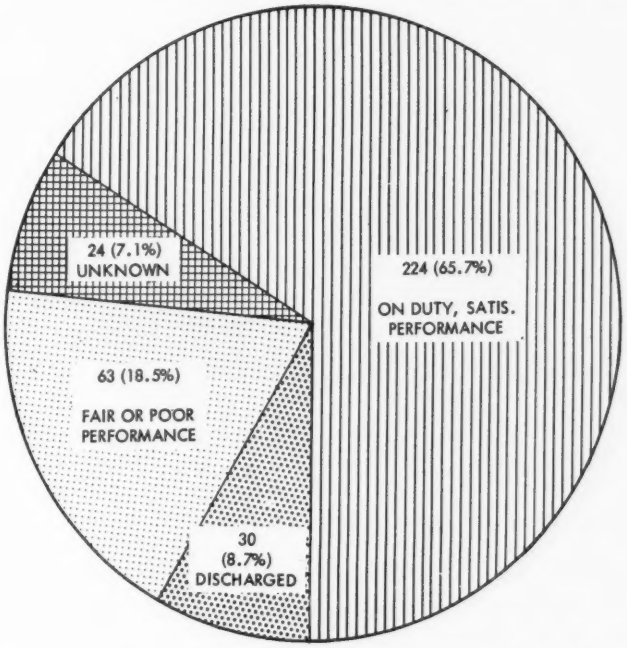
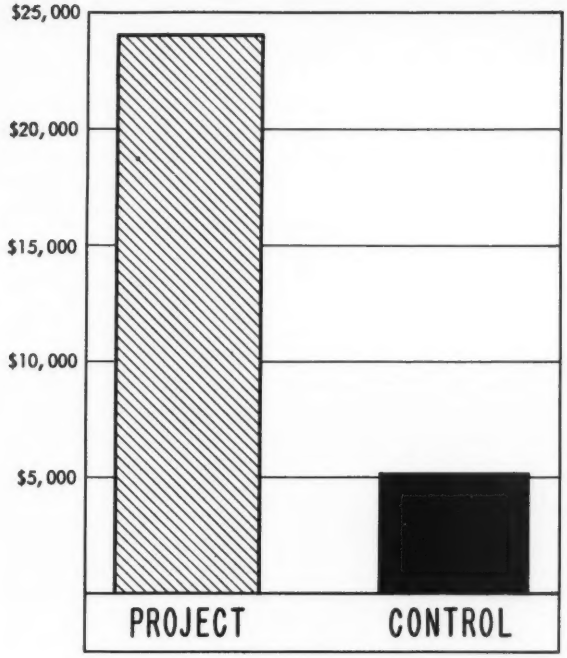


Figure 2. Performance and duty status of the control group (with S-1 labels) of 341 airmen.

men (18.5 per cent) were rated as fair or poor performers at their next base. Thus a total of 27.2 per cent could be considered failures or potential failures. It should be noted that the percentage of confirmed failures (*i. e.,* discharged) in the control group was 8.7 per cent. Thus in the control group, 224 men (65.7 per cent) remained on duty and were rated as satisfactory in performance.

Hospitalization during the basic training period also presents a contrast (fig. 3). Fifty-three men in the project group were hospitalized in comparison with 15 men from the control group. In terms of costs, project group men cost 1,412 days of hospital-



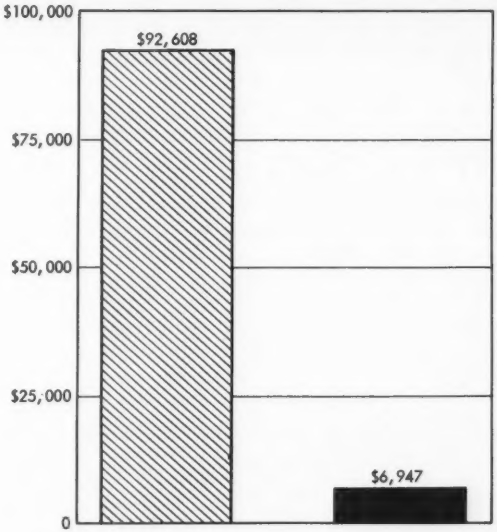
	PROJECT	CONTROL
NO. OF MEN HOSPITALIZED	53	15
TOTAL DAYS IN HOSPITAL	1412	305
TOTAL HOSPITALIZATION COST ($17.00 PER DAY)	$24,004	$5,185

Figure 3. Hospitalization cost for project and control group.

ization, which is computed to mean $24,004. The control group was hospitalized for 305 days at a cost of $5,185.

An estimation of the price of administratively discharging the men (fig. 4) revealed that the control group cost the Air Force $6,947, and the project group cost $92,608.

The AWOL rate showed a wide difference between the two groups. Three men from the control group went AWOL during the period studied. Thirteen men went AWOL from the project group in the same period.



PROJECT GROUP				CONTROL GROUP			
AFR	39-12 7	$ 659	$ 4,613	AFR	39-12 2	$659	$1,318
	39-14 19	544	10,336		39-16 4	710	2,840
	39-16 58	710	41,180		39-21 1	710	710
	39-17 5	986	4,930		35- 4 3	693	2,079
	39-21 21	710	14,910				$6,947
	35- 4 21	693	14,553				
	35-66 2	1,043	2,086				
			$92,608				

Figure 4. Cost in administratively discharging men of project and control group.

DISCUSSION

Considering the attrition and/or malfunction rate of both groups, it appears that the prediction of success or failure in military duty as indicated by the S profile was a reasonably accurate forecast. In regard to discharges alone, the project group predictions were correct roughly 6 times out of 10. The control group predictions were correct some 9 times out of 10.

Any conclusions suggested by these findings must necessarily be tempered by the limitations of the setting and by the methodology employed in the evaluation and follow-up. The population was small. However, certain questions can be raised. Is a correct prediction of 6 out of 10, as in the project group, efficient enough considering the current manpower pool? What would it cost to raise the successful predictions to 7 out of 10, or 8 out of 10?

It is of interest to note that a fairly conventional psychiatric screening procedure (based on the usual notions of mental health or illness) correlated well with the military administrative "pass or fail" index, utilizing performance as the sole measure. Thus the psychiatric screening procedure is presumably justified because by its use the costly delay in eventual administrative detection of failures is reduced.

It is believed that this small project might be expanded to include a follow-up of the rejectees who are released to the civilian community—doubtless to be screened again by industry. Perhaps through some benign method of cataloging the occupational fate of these men, the recurring recruiting and training cycle might be unclogged, to the advantage of the individual and his technological world.

SUMMARY

It was assumed that recruits could be tested for "success," "potential success," and "nonsuccess." The standard for nonsuccess was simply discharge from the Air Force. The hypothesis was that by employing a fairly conventional psychiatric screening process (in an abbreviated form under given conditions) it would be possible to predict which men would stay in the ranks and which men would be discharged within six months of reporting on active duty. The study was performed at a large Air Force basic training base. A project group of 341 men was selected as "bound to be unsuccessful" (*i. e.*, discharged). A control group was created of 341 men matched to the project group for characteristics like age, participation in same training unit, marital status, hometown area, et cetera. These two groups were followed at the basic training center and at the next duty station. Throughout the study the decision-making on prediction was carefully insulated from the decision-making on discharge. The findings were that the psychiatric predictions of "discharge" or "no discharge" were valid to a degree larger than obtainable by chance.

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USE OF THE MEMBRANE FILTER FOR POTABLE WATER IN THE AIR FORCE

THOMAS C. JONES, *Major, USAF (MSC)*

THE PRODUCTION of potable water under field or combat conditions has always been a problem of major importance to military commanders. Quality of a water supply as well as quantity have been essential to prevent a breakdown of functions at a critical or inopportune moment. "Tactical missions cannot succeed unless troops have enough *safe* water. Water is even more important than food. Untreated or improperly treated water almost always contains enough disease organisms to make it dangerous to drink. The health of the entire command is in the hands of the water purification equipment operators. They must know their job and do it right."[1]

The United States Armed Forces have met the challenge of providing safe water. Sand-pressure filters, chlorine, and halazone tablets were used during World War II to ensure potable water. The water purification set, diatomite, 50 g. p. m. (gallons per minute) capacity, became generally available toward the end of World War II and was used in Asia and the Pacific areas. Diatomite equipment was invaluable during the Korean campaign. These units are now standard Air Force and Army equipment for producing potable water under field conditions, at advanced air bases, isolated sites, at temporary installations, and during emergencies. Complete units are light in weight, readily transportable by cargo aircraft or truck, can be set up, placed in operation inside of 8 hours by 3 to 4 men, and are capable of producing up to 60,000 gallons of water per day of practically zero turbidity from almost any surface source that does not contain excessive pollutants of a chemical, salty, or oily nature. The diatomite filter was developed to provide a method that could guarantee absolutely the removal of amebic cysts and *Schistosoma cercariae* from raw surface water sources. It does this admirably and in addition removes about 90 per cent of the bacteria. Organisms that pass through the filter are killed by chemical disinfection with chlorine.[1,2]

Submitted in 1957 to the Department of Sanitary Engineering, University of North Carolina, Chapel Hill, N. C., in partial fulfillment of requirements for the degree of Master of Public Health. Maj. Jones is now assigned to Headquarters, Tactical Air Command, Langley Air Force Base, Va.

The question might well be asked: How does one know the diatomite filter accomplishes all of this? The filter has been time-tested in the field and bacteriologic analyses have been made of the finished water that bear out the claims made for this unit. In many remote or isolated field situations, however, no bacteriologic laboratory has been available for water quality control. Quality control has been largely of a chemical and physical nature, consisting of water reconnaissance surveys, coagulation, filtration, and terminal chlorine disinfection. The lack of a light, compact, and rugged portable laboratory for determining the coliform index of field water supplies has been recognized by medical service preventive medicine personnel and field operators. This problem was largely solved on 31 January 1957 when the Air Force authorized lower echelons to procure membrane molecular filter portable laboratories for field use.[1] It is anticipated that with the portable membrane filter kit available for quality control, water of a quality commensurate with approved municipal supplies will be processed and delivered in the field.

THE NEED FOR FIELD WATER LABORATORIES

Responsibility for a safe water supply under field conditions is a command responsibility. The Installation Engineers are responsible for the supervision and accomplishment of all work entailed in providing a safe and adequate supply. The Medical Service is charged with the responsibility for conducting investigations to determine the suitability of a supply from the standpoint of health preservation; this in turn requires surveys of sources, treatment measures, collection and analysis of water samples, and interpretation of results. The services of a sanitary engineer should be utilized for the evaluation of water supplies whenever possible.[2]

Water for military supplies may be obtained from several types of water sources. Under combat or field conditions and at advance bases, it is necessary to use any source that is available; often this consists of highly turbid and contaminated surface sources such as were encountered in Korea. Providing a safe water in quantity places a great responsibility on the installation engineering noncommissioned officer in charge of the water point. Medical service preventive medicine personnel share this responsibility because on them rests the decision of passing on the quality of the water supplied to all personnel at the forward area. History shows that this responsibility was not taken lightly in World War II and Korea as shown by the low incidence of water-borne disease outbreaks that occurred during these conflicts.

In spite of this excellent record, control of water quality in the field, to a great extent, has depended on chemical disinfec-

tion. This was caused in many instances by the lack of adequate laboratory facilities and refrigeration, due to distance, inadequate transportation, the time factor, and in some instances enemy interference. It is a military maxim to regard all water as unsafe until proved otherwise, in other words when in doubt, "don't hesitate, chlorinate."

In situations such as those described above, the portable membrane filter laboratory kit, now available to the Armed Forces, would have been invaluable.

DESCRIPTION OF THE MEMBRANE FILTER

The membranes used in this technic are basically different from ordinary cellulose filter paper and other types of filtering materials. They consist of a highly porous jel of complex cellulose ester polymers. The membranes have a thickness of about 150 μ (0.006 inch) and a porosity of 80 to 85 per cent. Under a differential pressure of 70 cm of mercury at 21°C they permit a flow rate of 70 to 80 ml of distilled water per minute through each square centimeter of exposed surface. A 47 mm disk has an effective surface filtering area of 9.6 square centimeters.[4]

Available commercially, the membrane filters vary in size from 0.5- to 9-inch disks and with pore openings varying from extremely small 10 mμ for virus studies up to 5 μ for particle sizing using air filtration. A satisfactory filter disk for field use consists of the 47 mm diameter and 0.5 μ pore size. Filter disks for use in the field are available with imprinted grids on the surface to facilitate counting. The grid subdivides the surface area so each square represents 1.0 per cent of the effective filtering area.[4]

Portable field laboratory equipment used with the membrane filter disk consists of a 500-ml stainless steel funnel, a stainless steel filter holder (used to support the delicate membrane disk), stainless steel or Pyrex suction flask, clamps, thermometer, valves, suction pump, flaming lamp, stamp collector's forceps for handling membrane disk, small scissors, distilled water, an incubator, and a vacuum bottle or an incubator vest. The equipment listed plus necessary media and supplemental reagents come in the packaged field kit weighing between 26 and 30 pounds.[5-7]

The evaluation of bacterial concentrations in water by means of the membrane filter technic involve five principal steps: (1) separation of the bacteria and other suspended matter from the water sample, and their collection on the upper surface of the membrane filter disk; (2) impregnation of the disk with nutrient liquid from a prefabricated pad to provide for total or differential culturing of bacterial colonies; (3) incubation of the membrane

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filter and nutrient pad assembly; (4) counting and evaluation of the types of bacterial colonies; and (5) preservation of the membrane filter disk as a permanent record.[4] The assembly of the apparatus and the filtering of the water after the sample has been collected can be accomplished almost as quickly as it takes to tell about it.

LABORATORY CONTROL OF MILITARY WATER SUPPLIES

The Armed Forces place great emphasis on bacteriologic examination of water consumed by personnel on military installations and under military jurisdiction. Laboratory examinations of water samples are essential to the maintenance of the quality of the water in accordance with established standards of potability. They provide a measuring stick for determining the quality of water drawn and the effectiveness of different treatment units. They also serve as a guide for adjusting water-treatment processes.[8]

Another requirement for military water supplies at fixed installations requires that samples should reach the laboratory within 12 hours after collection whenever possible.[8] This is sometimes difficult of accomplishment and in field situations often impossible.

Military water samples are examined in accordance with accepted procedures,[9] and consist of the standard 3-dilution, 5-tube most probable number (MPN) determinations of coliform density. To process water samples using MPN determinations requires a well-equipped laboratory, highly trained technicians, and considerable time, at least 48 hours if only the presumptive test is run. It is quite evident that under field conditions the collection, icing (if possible), and shipping of water samples when laboratories are available is quite a chore. Results often are not received for a week or more and are too late to do much good, especially if the water point has been moved to a new location.

The MPN method of bacteriologic water analysis has been in use for a considerable period of time, while the membrane filter method for all practical purposes is comparatively new, having been introduced into the United States from Europe in 1947. "The adoption of membrane filters in Germany during World War II was brought on largely by the exigencies resulting from mass bombings and the shortage of trained laboratory personnel. With glassware shattered, and incubators at a premium, health departments of several cities such as Hamburg and Stuttgart found true economies of equipment and labor in the membrane filter procedure."[10] Since that time the technic has been evaluated by numerous investigators who have reported on membrane filter applications for many different purposes and under varied conditions. Private and state university laboratories, the United

States Public Health Service, and the Army Environmental Health Laboratory have been instrumental in the continued development of membrane filter technics.

Accuracy, reliability, cost, time of making analyses, and time involved in training technicians must be considered in evaluating the two methods. This is best done by describing the laboratory research and practical work accomplished by the various investigators studying the capabilities of the membrane filter.

COMPARISON OF THE MEMBRANE FILTER AND MPN METHODS IN EXAMINING SEA WATER

A comparison of the membrane filter and MPN technics was made by Presnell, Arcisz, and Kelly[11] in examining sea water. They performed carefully controlled experiments to determine the effect of bacterial densities on the agreement of results of the two methods, and the influence of turbidity on the agreement of results.

Water samples were collected from three stations selected on the basis of degree of pollution and turbidity. Stations were designated A, B, and C. Station A represented an approved shellfish producing area with an MPN per 100 ml of 70 or less, Station B represented a median area (restricted) with MPNs of 70 to 700 per 100 ml, and Station C represented a closed area with MPN exceeding 700 per 100 ml. Samples to be examined were taken twice daily and collected in accordance with standard procedures. Time elapsing between collection and beginning of examination of samples never exceeded two hours.

Included in table 1 are the comparable coliform densities obtained by membrane filter and MPN methods using the 95 per cent confidence limit of recorded MPNs as a base line.

TABLE 1. *A comparison of coliform densities in sea water as determined by membrane filter and MPN methods*[11]

Station	Average turbidity p. p. m.	Number of samples	Number of samples agreeing	Number of samples disagreeing	Per cent agreement
A	8	46	36	10	78.3
B	20	45	37	8	82.3
C	14	48	48	0	100.0
All stations	14	139	121	18	87.1

Summarizing the results of this experiment, it may be said that:

1. The two technics gave results 87 per cent in agreement.

2. Results obtained from waters having high coliform counts gave better correlation than results obtained from low coliform density waters.

3. Water turbidity greatly influenced the coliform recovery rate and should be considered in conjunction with bacterial density in determining the volume of sample to be filtered.

4. Presnell and associates concluded their report by stating: "The time and material-saving features of the membrane filter method as compared with the MPN technique make it particularly desirable for examining the frequently large number of samples required for determining sanitary quality of water in shellfish producing areas."[11]

TIME AND COST FACTORS

Renn found that "the separate operations of preparing quantitative liquid media for MPN estimations of bacteria and the business of washing up glassware after each run was consuming roughly 40 per cent of the working time."[12] In short, he estimated that the bacteriologist on the project was reduced to a half-time bacteriologist. With the adoption of the membrane filter method of bacteriologic analysis, the limitation on the bacteriologist's production rate was set by the time spent in counting membranes. The time required for preparing samples and time for cleanup was reduced to insignificant levels. This resulted in a great saving of time and money.

The experience gained with the membrane filter in experimental studies led to its adoption at the Johns Hopkins University for class laboratory use. The student groups were made up largely of young civil engineers, none of whom were especially good laboratory technicians. The membrane filter was particularly well suited for use by these students as the technics of working with it were easily learned and resulted in a saving of time.[12]

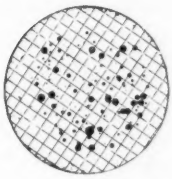
An interesting secondary use of the membrane filter technic is the preparation of permanent records of critical experiments. Demonstrations of results can be made by placing the dried preserved membranes in transparent plastic folders mounted on bristol board or other suitable material.

The preservation and mounting of membranes for permanent records of water samples is shown in figure 1. This is a reproduction of a preserved membrane, with sheen colonies easily apparent. Pertinent data regarding the water sample is recorded in the space below the membrane.

Preserved Membrane Filter Disk

Field Water Sample Report

*Mount Membrane here



Sample No._____Date_____Time_____

Location_____Source_____

Organization using water_____

Appearance_____

Contaminating factors_____

NCO in charge of water point_____

Collected by_____

Analyzed by_____

Volume of sample filtered in ml _____

Coliform count per 100 ml _____

Kind of medium used_____

Incubation time_____Temperature_____

Remarks_____

_____

*Preserved membrane. (Courtesy of Salem-Brosius, Inc.[6])

Figure 1. Example of permanent records using membrane filter disk as part of potable water report.

This type of record occupies little space, is inexpensive, graphic, and easily understandable. It will be of great benefit to military preventive medicine personnel and field water plant equipment operators. A record such as this should be especially valuable as a timesaver, eliminating the need for computing MPNs and writing out rather detailed (and often misunderstood) reports.

ADVANTAGES AND DISADVANTAGES OF THE MEMBRANE FILTER RELATIVE TO MPN METHODS

Advantages of the Membrane Filter Relative to MPN Methods

1. One of the principal advantages of the membrane filter is that with its adoption by the Armed Forces, a portable membrane filter bacteriologic laboratory is now available for water-sample analysis at water points located in isolated areas; whereas so often in the past, no method of determining water quality has been available other than by chemical and physical methods.

2. Eliasson stated: "Precision has been achieved far beyond that conceivable by any other method of coliform analysis."[11] "It is desirable to keep in mind the fact that, unless a large number of portions of sample are examined, the precision of the fermentation tube test is rather low. For example, even when the sample contains 1 coliform organism per ml, about 37 per cent of 1-ml tubes may be expected to yield negative results, because of irregular distribution of the bacteria in the sample. When 5 tubes, with 1-ml sample in each, are employed under these conditions, a completely negative result may be expected less than 1 per cent of the time.

"Even when 5 fermentation tubes are employed, however, the precision of the result obtained is not of a high order. Consequently, great caution must be exercised when interpreting, in terms of sanitary significance, the coliform results obtained from the use of a few tubes with each dilution of sample."[9]

3. Results are obtained in a relatively short period of time. "It has been variously estimated that between 40 and 50 per cent of the time used for running MPN determinations is used for the preparation of media and washing up. Less labor per sample is required for the membrane filter technique. Labor in today's laboratories is a major factor in cost."[10] The greater productivity of existing (laboratory) personnel makes the membrane filter technic even more attractive.[12, 13]

4. The membrane filter lends itself to field use. The portable kits permit "on site" filtration and incubation of water samples within a few minutes. The samples, if incubation is not available, can be filtered and the membrane filter disk shipped to a laboratory on a preservative medium at ambient temperatures. Results of this method have proved satisfactory.[10, 13, 14]

5. Greater reliability is achieved by securing actual bacterial numbers at the sampling site rather than after growth or die-off during transit to the laboratory.[13]

6. Another factor which gives the membrane filter an advantage is its versatility. It can be used for many other purposes other than for water sampling. Not the least of these is the fact that it can be used as an air-sampling device.[15, 16] This will be covered in subsequent discussions in more detail.

7. Space is of paramount importance whether it be under field or laboratory conditions. The membrane filter meets the requirements of space and weight satisfactorily, the field kit being no larger than an ordinary suitcase and weighing approximately 30 pounds complete.

8. Preservation of membrane filter disks as a graphic, compact method of retaining permanent results of water-sample analyses is a major advantage. The disks preserved and mounted on suit-

able material tell a picture story. Individuals totally unfamiliar with bacteriology can inspect visually and quickly be made to understand the significance of colonies growing on a membrane filter, whereas trying to explain the same results reported from MPN data is extremely difficult, not to say impossible.

9. Training military preventive medicine and laboratory technicians and specialists in membrane-filter technics will require less time and equipment than similar training involving MPN determinations.

Disadvantages of the Membrane Filter Relative to MPN Methods

1. The coliform density estimates obtained using the membrane-filter technics are generally less than the MPN method. The difference in density estimates is partly but not wholly the result of the mathematical bias of MPN. There is also some question as to whether the same organisms are counted in the two tests. More study is needed.[10]

2. In waters containing unusually large amounts of algae, clogging of membranes may preclude testing large enough samples to provide a reliable indication of coliform density.

3. In highly turbid waters filter clogging may limit usefulness.

4. Variations in skill of individuals in recognizing and distingishing the characteristic sheen colonies may cause variations in results.

5. Cost of membrane filter disks are greater in comparison than the costs of media required for "negative" fermentation tube tests. This is narrowed when a good many tests require confirmation or completion. The cost of membranes should go down as they come into more common use.[10]

OTHER USES OF THE MEMBRANE FILTER

Among the advantages listed for the membrane filter was one concerning versatility. Experimenters have worked on, and are presently engaged in research on applications of the membrane filter technic in air-pollution studies, evaluating air cleaners, isolation and identification of microorganisms in food and dairy products, collection of radioactive and fluorescent particles for detection purposes, isolation and identification of biological pathogens, analysis of sewage and industrial wastes and many other areas.

Microbiologic air pollution. Goetz[16] discussed a specific method for the collection of microbiologic air contaminants which employs an initial conversion of the airborne matter into a liquid suspension in the presence of protective colloids by an impingement process, followed by further concentration and subsequent nutrition on molecular filter membranes.

Size determination of silica particles. Burke[17] discussed the sampling of silica dusts by means of the membrane filter. The dust was collected on a membrane filter, the filter dissolved by means of an organic solvent, and dust particle size determined by turbidimetric methods. The method was adjudged reliable and rapid.

Use of the membrane filter in the measurement of biological incorporation of radioactive isotopes. Atkinson and McFadden stated: "The estimation of total isotope incorporation into metabolizing cells is often necessary. In such cases direct counting of radiation from the intact cells will generally be desirable. The main requirement for accuracy is removal of radioisotopes external to cells and uniform plating of a suitable thin layer of cells."[18]

The membrane filter was found suitable for the collection of samples for counting. The time required was less than other methods since the cells were retained quantitatively *on* rather than *in* the filter. Absorption of radiation by filter was found to be negligible.

Dairy products. Rodriguez and Walter[19] described the use of the membrane filter in evaluating dairy products consisting of butter, ice cream mix, and ice cream. Their findings indicate that under laboratory conditions the membrane-filter portable field kit produced results comparable to those obtained employing standard methods. They justified its use for the microbiologic rating of butter, ice cream mix, and ice cream.

Isolation of organisms from spinal fluid. Wayne and Juarez[20] reported their success in using membrane filter technic for isolating *Coccidioides immites* from the spinal fluid of two patients having coccidioidal meningitis. They had been totally unable to isolate the organism from either patient by standard technics.

PROPOSED AIR FORCE TRAINING PROGRAM IN THE USE OF THE MEMBRANE FILTER

It is expected that the membrane filter since its adoption by the Air Force for field use will become, in the not too distant future, a standard item of equipment for use by preventive medicine personnel, Air Force laboratories, water and sewage plants, and other Air Force owned or operated facilities requiring laboratory analyses.

Prior to any widespread use of the membrane filter by Air Force preventive medicine personnel, laboratory personnel, or water and sewage plant operators, it will be necessary to initiate a training program in the use of the membrane filter. This can be readily accomplished by including hours for training in the curriculums of existing courses for preventive medicine and laboratory

technicians currently being taught at the School of Aviation Medicine, Gunter Branch, Gunter Air Force Base, Ala.

Training accomplished at the School of Aviation Medicine will serve a threefold purpose: (1) provide a trained corps of military personnel familiar with membrane-filter technics who will be available in the event of emergencies; (2) stimulate interest in membrane-filter methods, which may result in additional research into improving existing procedures and developing new applications; and (3) eventually cause a saving in dollars and cents by the reduction in time involved in making routine laboratory water analyses based on global deployment of the Air Force.

Command Surgeons can accomplish training in the use of the membrane filter for personnel unable to attend a formal training course by delegating a responsible officer, preferably the Command Sanitary and Industrial Hygiene Engineer, to initiate a training program at base level. Base clinical laboratory officers and sanitary and industrial hygiene engineering officers can serve as instructors to enlisted personnel on an "on the job training basis." In the event these officers are not familiar with membrane-filter technics, arrangements can be made with the United States Public Health Service for them to receive training at the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

There is a possibility also that the manufacturers of membrane-filter field kits[5-7] would co-operate in a training program by demonstrating and giving a familiarization short course on membrane filter applications to certain key personnel, such as the instructors in preventive medicine and clinical laboratory courses at the School of Aviation Medicine, Gunter Branch.

SUMMARY AND CONCLUSIONS

The lack of adequate bacteriologic water quality control under field conditions has been discussed. In the past this control was dependent on chemical and physical disinfection because of a lack of practical, portable bacteriologic laboratory equipment for water analysis. The adoption by the Air Force of the membrane-filter portable field kit in January 1957 has provided preventive medicine personnel with the equipment needed to make rapid, precise analysis of field water supplies. The membrane filter was compared and evaluated against the standard MPN method of bacteriologic water analysis with the following conclusions:

1. The adoption of the membrane filter by the Air Force for use in the field was a definite step toward improving water-quality control at advanced bases, isolated installations, and at field water points.

2. The increased precision over existing methods of water analysis will make the membrane filter a very useful tool for

military medical laboratories at fixed installations where routine water quality control tests are performed. Its use would result in a great saving of time, equipment, and money.

3. The adaptability and versatility of the membrane filter would make it a useful diagnostic tool in clinical laboratories, industrial plants, and other Air Force facilities requiring laboratory control.

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Uncomplicated Pregnancy Following Bilateral Lung Lobectomies

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THE OCCURRENCE of pregnancy following pneumonectomy is unusual inasmuch as diseases requiring pulmonary surgery are infrequent in women of childbearing age. Formerly the two most common indications for resection were bronchiectasis and certain lung abscesses. However, with the increasing list of indications for, and the decreasing mortality and morbidity following extensive pulmonary surgery, it is likely that in the future more women with pulmonary resections will become pregnant. Although this combination will present a serious problem, the outcome is not necessarily unfavorable.

CASE REPORT

A 19-year-old woman had a history of cough productive of large amounts of sputum since the age of six months, at which time she was said to have had pneumonia. The cough was characteristically worse in the morning and was productive of large amounts of yellow phlegm. At times there was hemoptysis associated with episodes of chills and fever. The cough was so severe that it was necessary to raise the head of the bed at night for ease of respiration. Past history also revealed maxillary and frontal sinusitis with head colds and a drainage from the right ear. The patient had had jaundice at the age of seven years and had been hospitalized for five weeks with apparent complete recovery.

In February 1953, the patient was seen at a university hospital because of the chronic productive cough. Examination revealed scarring of the right tympanic membrane and tenderness over the right mastoid area. The tonsils were hypertrophied to grade III and were slightly injected. There was a mucopurulent postnasal discharge. Cervical adenopathy was noted bilaterally. Examination of the lungs revealed bronchial type breathing with vocal fremitus increased in both bases posteriorly and laterally and some generalized rales and rhonchi. There was some clubbing of the fingers and toes. Bronchograms showed bilateral lower lobe bronchiectasis. Sinus films were negative. Vital

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capacity revealed 39, 33, and 39 per cent on three occasions, with a total pulmonary capacity varying from 1,000 to 1,200 ml of inspired air.

In March, a right middle and lower lobectomy was performed. Postoperatively, the patient did well and the hospital course was uneventful and uncomplicated. Following discharge the sputum decreased in amount to less than a half cup per day. There was a moderate gain in weight and no more episodes of hemoptysis. The dyspnea was decreased in severity. The patient returned to the university hospital in November for re-evaluation. At this time, vital capacity was approximately 47 per cent. A bronchogram showed involvement with bronchiectasis of the left lower lobe and lingular segment of the upper lobe.

In November, the left lower lobe and the lingular segment of the left upper lobe were resected. Again the patient ran an uneventful postoperative course and two weeks postoperatively the vital capacity was found to be 1 liter or 33 per cent of normal. Following the second discharge from the hospital, the patient again did fairly well for many months but in the latter part of 1954 she again developed an increased amount of cough and recurrent episodes of hemoptysis and pleuritic chest pain. The cough became productive of increased amounts of yellow sputum and the patient had recurrent bouts of pulmonary infection with fever and leukocytosis.

The patient was first seen in the clinic of this hospital in October 1955, at which time she was found to be in about the second month of gestation. This was her first pregnancy. Her last menstrual period began 16 August and was of two days' duration. The previous menstrual period began 1 July and was of five days' duration. Examination revealed numerous rhonchi and coarse bubbling rales in both lung fields, slightly hyperresonant to percussion. There were no areas of dullness. Clubbing of the fingers was present. Pelvic examination revealed a uterus enlarged to the size of a 2½-month pregnancy. Fetal heart tones were not heard. A roentgenogram showed the trachea to be slightly deviated to the left. Both diaphragms were elevated and the costophrenic angles were blunted bilaterally. A mild compensatory scoliosis to the right was present, giving the cardiac shadow the appearance of lying mostly in the left lung field. The left diaphragm was more elevated than usual and the supradiaphragmatic area was considerably hazy, because of old pleural adhesions. No active underlying lung disease could be detected. An electrocardiogram was within normal limits. Hemogram and urinalysis were within normal limits. The serologic test for syphilis was negative. The sputum was negative for acid-fast bacilli. The patient's blood was Type A, and Rh negative. A vital capacity at that time was 2.4 liters.

Because of the apparent increase in vital capacity and inasmuch as the patient had no dyspnea and her health did not seem to be affected adversely, the pregnancy was allowed to continue. The patient was

seen at frequent intervals in the medical and the prenatal clinics thereafter. She frequently complained of chest pain, cough, tightness in the chest, difficulty in bringing up secretions, and recurrent low-grade infections with slight fever. However, there were no complaints of increased dyspnea. Treatment consisted of expectorants, prophylactic antibiotics, and an injection of influenza polyvalent vaccine. Roentgenograms of the chest taken at frequent intervals showed no appreciable change in the appearance of the lung fields. Three electrocardiograms showed no evidence of myocardial disease or of ischemia. No Rh antibodies were present on frequent tests throughout the pregnancy.

At about the seventh month of gestation the patient went into premature labor and spontaneously delivered a 4 pound 14 ounce living infant under local 1 per cent Novocain (brand of procaine hydrochloride) pudendal block. There was no dyspnea, cyanosis, chest pain, or other unusual symptoms. There was a moderate postpartum hemorrhage, and a transfusion of 500 ml of whole blood was required.

The immediate postpartum period was uneventful, but on the seventh postpartum day the patient developed a sudden, very severe pain of a stabbing quality in the left lower portion of her chest. She also developed dyspnea and faintness and when first seen was quite pale and complained of numbness of her arms and feet. Vital signs were not impaired. She was treated with oxygen and narcotics, and after several hours the pain disappeared. The following day a similar episode occurred and again was relieved by narcotics. Blood cell counts following this episode were always within normal limits. Daily roentgenograms revealed no evidence of pulmonary infarction or of other changes. Electrocardiograms showed no change from the previous tracings. There was no hemoptysis, fever, or leukocytosis. After the second episode, the patient had no more difficulty and was discharged on the seventeeth postpartum day in good condition. The mother and infant were discharged in good condition.

The patient was seen several times during the following six months and her condition from an obstetric standpoint was normal. She continued to have recurrent bouts of pulmonary infections, however, and required frequent courses of antibiotics. Her dyspnea, weight, and general condition remained about the same as prior to pregnancy. Vital capacities were 1,500 and 1,200 ml on two occasions.

At this time bronchography, utilizing one of the rapidly eliminated opaque media, was contemplated; however, before the opaque media desired could be procured, the patient moved elsewhere.

DISCUSSION

This case presented an interesting problem in the differential diagnosis of postpartum chest pain. First, the various forms of chest wall pain must be considered, although as a group they are not particularly increased in incidence or aggravated by

delivery or pregnancy. Intercostal neuritis is usually fairly easy to recognize, and the segmental distribution of herpes zoster is characteristic. Spinal cord lesions and mechanical nerve root compression are related more specifically to coughing, sneezing, and straining, and other activities which increase the cerebral spinal fluid pressure. The pain of intercostal neuritis is usually lancinating with electric shock sensations and can be aggravated by stimulation of the nerve proximal to the point of pain. Muscular pain in the chest wall, such as that in acute torticollis, is familiar and easy to recognize. However, it is not so well known that myositis may also involve the rhomboid group of muscles and the shoulder girdle muscles at their thoracic attachments. Costochondral pain is probably much more frequent than is generally realized. This syndrome, first described by Tietze, consists of clearly localized pain in one or more of the cartilages with tenderness to pressure and usually with a palpable enlargement of the cartilaginous bridge adjacent to the bony rib. The pain is usually of a dull character with little relationship to respiration or movement, and it may be quite severe. Injury to the chest wall sustained after delivery while the patient is unconscious or under the influence of narcotics and analgesics probably occurs more than we are willing to admit. Special precautions must be taken to prevent the patient from being rolled onto the grip handles of the delivery table. Finally, "rheumatic" pains, including fibrositis and spondylitis, must be considered, although they are of infrequent occurrence in the thoracic region.

Cardiovascular pains usually occur in the older age group, although they are not by any means unheard of in the childbearing age. Most frequent of these perhaps is myocardial infarction. The characteristic substernal pain with radiation into the left shoulder is easy to recognize. The diagnosis is confirmed by the increased white blood cell count, sedimentation rate, and the characteristic electrocardiographic picture. Pericarditis occurs very frequently in the younger age group and may be difficult to distinguish from other types of cardiovascular diseases. The presence of a friction rub together with a characteristic electrocardiographic pattern, however, is usually present. Aortic pain is becoming increasingly infrequent and usually occurs only in older age groups. The diagnosis of this disease may be very difficult unless the possibility is kept in mind. The pain is described as a deep, boring, agonizing type pain, comparable to a severe toothache. It is either retrosternal or may be posteriorly located when an aneurysm exerts pressure on the thoracic spine. Other symptoms arising from pressure and encroachment of the aneurysm also may be present.

Abdominal diseases are well known to cause referred pain in the chest. Probably the most frequent of these, and one which might occur in the childbearing age, is the splenic flexure syn-

drome. This diagnosis unfortunately must be made only after other organic causes of similar pain have been eliminated by thorough studies. Gallbladder disease may cause referred pain in the right shoulder and, occasionally, in the left shoulder and other areas of the chest. Other characteristic signs and symptoms of gallbladder disease, however, are usually present. Subdiaphragmatic conditions, with hemorrhage or infection in the reproductive organs, may be associated with pregnancy and delivery.

Mediastinal diseases and those not involving the parietal pleura and pericardium may exert referred pain to the chest wall and may indicate serious intrathoracic disease. The pain is described as a vague, indefinite sense of distress in the region of the pathologic process, and diagnosis may be very difficult.

The most common causes of chest pain in the childbearing age, and which would be associated with pregnancy and delivery, are those diseases causing irritation of the parietal pleura. The most common of these, of course, is pneumonia. This diagnosis immediately comes to the mind of all who see patients with thoracic pain and the characteristic rales, friction rub, cough, expectoration, and elevated white blood cell count, and roentgenographic findings usually make the diagnosis simple. Pneumonia occurs more frequently following delivery because of decreased defensive mechanisms against disease and because of aspiration of secretions associated with anesthesia. Pulmonary embolism is not uncommonly associated with delivery. This disease produces a characteristic pleurisy associated usually with hemoptysis, and if the embolus is of sufficient size, with a characteristic plaque-like appearance on roentgenographic examination within a day or two. There is also a leukocytosis and elevated sedimentation rate. Activation of a pulmonary tuberculous process is increased during pregnancy and may manifest itself only after delivery. The roentgenographic appearance usually explains the cause of the pain immediately. Malignant diseases may be increased during pregnancy because of the influence of the great alteration in sex hormones.

Lastly, there must be considered the pleural pain caused by pulling of adhesions on the parietal pleura associated with the sudden decrease in intra-abdominal mass and the sudden lowering of the diaphragm. This process is not discussed to any extent in the literature, but it apparently is not infrequent in patients who have had previous pulmonary disease and have developed pleural adhesions. It is largely a diagnosis of exclusion and should be made only after the previously discussed causes of pleural pain have been eliminated. There is no roentgenographic change, leukocytosis, or increase in sedimentation rate. I believe that our patient experienced this type of pain.

COMMENTS

No other case of pregnancy with such extensive pulmonary resection is found in the literature. As has been pointed out before, the degree of function following resection depends not so much on the amount of lung left as upon the age of the patient and the excellence of function of the chest wall and of the diaphragm.[1] It is well known that the load of pregnancy causes an increased oxygen requirement, increased blood volume, and increased work of the heart. Long and associates,[2] however, reported a case of pregnancy following a right pneumonectomy for adenocarcinoma in which there was no significant change in the ventilatory portion of the respiratory function. Wright,[3] Pilheu,[4] and Kellerman and Smith[5] reported other cases in which there was no subjective increase in dyspnea during gestation. Thus, in none of the five above-mentioned cases was there any evidence that pulmonary capacity is impaired by pregnancy, and indeed, in three of the cases there was a slight subjective improvement. Thomson and Cohen [6] suggested that vital capacity increases slightly as pregnancy advances and the subcostal angle widens, but there is probably an additional mechanism in effect following resection. There is always a degree of compensatory emphysema following removal of lung tissues and the enlarging uterus probably aids pulmonary function in the same manner as does an emphysema belt or a pneumoperitoneum. With this reasoning the danger period would be in the immediate postpartum period, and such was the case in two of the deliveries. Our patient experienced pleural pain on the seventh and eighth postpartum days, probably due to tension on visceroparietal adhesions.

While therapeutic abortion can be justified in a woman following pulmonary resection, the evidence, though small, indicates that this is not always the wisest course. Many patients will desire to proceed to term, and if kept under careful observation, they may be allowed to do so in selected cases where no other complications are expected.

SUMMARY

A case is presented of a patient with a right middle and lower, and a left lower lobectomy and lingulectomy who had a normal, uncomplicated pregnancy and a spontaneous, but premature, delivery. It is suggested that many selected postpneumonectomy cases may safely be allowed to proceed to term.

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COBALT-60 TELETHERAPY IN CANCER

"Cobalt-60 teletherapy is essentially a from of supervoltage. radiation. There is no specificity of action on the various modalities of supervoltage, and it is a misconception to suppose that Co^{60} teletherapy has something to offer when 2-million-volt x-ray therapy has not. Both offer the possibility of increasing the dosage of radiation to tumors because of better skin tolerance and a slight increase in tolerance of the deeper structures. But both must be used with due regard to the possible later appearance of subcutaneous and deep muscle fibrosis and other signs of cumulative damage, and the curability of a tumor is one of its fundamental biological properties. Supervoltage or Co^{60} teletherapy is not indicated in a number of conditions, e. g., lymphomas in areas of superficial lymph nodes. Its use is elective in a number of other conditions, e. g., mediastinal and retroperitoneal lymphomas. Its use is imperative in a considerable number of conditions, including cancers of the oropharynx and urinary bladder and late cancers of the cervix and vagina. It has technical advantages that need to be explored further, but an objective and unemotional approach is necessary."

—GILBERT H. FLETCHER, M. D.
in *Journal of the American Medical Association*
p. 244, May 18, 1957

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Generalized Skin Eruption Caused by Bromsulphalein

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THE Bromsulphalein (brand of sulfobromophthalein sodium) excretion test has become one of the most acceptable and valid of those used for determination of liver function. When one compares the number of times the test has been used and the relative paucity of published reports on its adverse effects, it becomes apparent that it is a relatively very safe procedure. More important, of course, are the occasions of adverse reactions observed by physicians which are never written up for publication or dissemination. In our own experience, and from communications with others, it would appear that except for an occasional local irritation from extravasation of the drug, the incidence of any generalized manifestation from Bromsulphalein has been nonexistent or very rare.

An acute allergic reaction in a patient with a history of bronchial asthma and who exhibited severe sensitivity reactions to many substances was reported by Chambers and Moister.[1] The reaction was evidenced by severe dyspnea, cyanosis, unconsciousness, and clonic convulsions. De Andino and McKeown[2] observed a case characterized by dyspnea, cyanosis, apprehension, and hypotension which appeared within three minutes after injection of the drug. Anaphylactoid reactions also were noted by DiCaprio and Troen,[3] Roth[4] and Morey, Gabuzda, and Scudamore,[5] and McVay.[6] Morey and associates reported two cases of mild local inflammatory reaction.

We have found no previous reports of generalized severe coalescing morbilliform rash resulting from the intravenous injection of Bromsulphalein, as manifested in the following case report.

CASE REPORT

A 44-year-old soldier was undergoing study for jaundice of four days' duration, associated with vague diffuse abdominal pain and anorexia. Physical examination findings were not remarkable except

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for obvious jaundice and a slightly palpable, nontender liver. Liver function tests showed a total bilirubin of 5.8 mg per 100 ml, with a direct bilirubin of 3.1 mg and an indirect 2.7 mg per 100 ml. Thymol turbidity was 2.6 units. Serum alkaline phosphatase was 16 Shinowara, Reinhart, Jones units. At this time a Bromsulphalein excretion test was performed using a total of 370 mg of dye (5 mg per kilogram of body weight) injected intravenously. Within about 1 hour the patient developed a nonpruritic, finely macular, generalized rash of the entire body except the palms and soles (fig. 1). Over the next several hours

Figure 1. The macular, coalescing rash involved the entire body except palms and soles.

the rash became more intense, began to coalesce and continued to do so for several days. Also noted was a temperature of 103°F which subsided in 1 day while the rash increased in intensity and after several days also subsided. Complete clearance of the rash took about 5 to 6 days. There were no clinical manifestations of other diseases in which a morbilliform rash is seen. Blood cultures, roentgenogram of the chest, and heterophile antibodies were all negative. The jaundice subsided in 2 weeks. The initial Bromsulphalein re-

tention was 67 per cent at 45 minutes. No further injection was given, but a skin test utilizing 1 ml of 1:10,000 Bromsulphalein and patch test using 1:20 concentration were both negative. A punch biopsy from the right leg showed aggregates of chronic inflammatory cells in the upper dermis, interpreted as dermatitis consistent with dermatitis medicamentosa. Gallbladder series showed cholelithiasis for which the patient underwent cholecystectomy uneventfully at a later date. He gave no history of any previous allergic manifestations and had never been exposed to Bromsulphalein previously.

SUMMARY

A case of generalized severe coalescing morbilliform rash caused by intravenous injection of Bromsulphalein is reported.

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Hindquarter Amputation for Hip Chondrosarcoma

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THE PURPOSE of this article is to describe an interesting case of chondrosarcoma of the hip apparently arising from a pre-existing synovial chondromatosis and to evaluate some of the more practical points concerned in the management of such a patient on whom a hindquarter amputation is to be performed.

Billroth attempted the first hindquarter or interinnomino-abdominal amputation 67 years ago; however, the patient died shortly after the operation, probably from shock. In 1895 Girard achieved the first successful hindquarter amputation, which consists of removing the entire lower extremity with the adjacent innominate bone. The principles of the surgical procedure were laid down by the English surgeon, Hogarth Pringle,[1,2] in 1909 when he reported three cases.

There are over 185 recorded cases to date, most of which have been performed for sarcoma. Prior to 1934 the operative mortality for this procedure was about 60 per cent. Since then the mortality has been less than 20 per cent, and the improvement may be attributable to the use of transfusions and better supportive measures. American surgeons did not gain interest in the operation until after 1940. In 1942 Leighton[3] reviewed the literature and reported three of his own cases. He pointed out that shock and prolonged suppuration were the chief causes of early death. Morton[4] reported four cases in which the amputation was done primarily as a palliative measure. He stressed the necessity for careful hemostasis and the avoidance of surgical shock. In England, Gordon-Taylor and co-workers[5,6] had the most outstanding experience in this field with over 21 personal cases in which their operative recovery was a commendable 71 per cent. The final prognosis was most favorable in the infiltrating chondroma or chondrosarcoma, some of their patients being free from recurrence nearly 10 years after amputation. Interestingly,

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most of their amputations were performed under spinal anesthesia and with the patient in a true lateral position. Gordon-Taylor and co-workers emphasized the need of a retention catheter during and after the operation, and the importance of having adequate blood supplies at hand. In 1946 Pack and Ehrlich[7] reported six cases of amputation for malignant tumors. They believed that the radical procedure served a distinctly useful role in the treatment of selected patients.

Beck and Bickel[8] reported 12 cases in their series from the Mayo Clinic. When the hip is primarily involved, pain may be severe and the tumor may be small and hard to demonstrate, as it was in our case. All of their cases had a temporary respite from pain. In 1949 Ariel and Hark[9] reported eight cases, and emphasis was placed on utilizing this procedure with dispatch when indicated. During the same year, Wise[10] reported his experiences with hindquarter amputation in five patients with primary malignant tumor of the innominate bone or upper part of the thigh. There was no operative mortality in his series. Saint[11] reported a case of osteosarcoma of the innominate bone treated by amputation about four months after the appearance of the tumor. The patient subsequently died a short time thereafter. Saint emphasized the necessity of early diagnosis of malignant disease if adequate removal of the tumor is to be successful, and his article contains an excellent discussion of the operative management. Coley, Higinbotham, and Romieu[12] reported a series of 14 cases, 3 of which were osteogenic sarcoma and 11 chondrosarcoma. They believed that the rather long-term palliation made the procedure definitely worthwhile. Necrosis of the skin flap and persistent sinus with residual abscess were the most frequent complications encountered. Coley and his associates believed that chondrosarcomata of the hip and pelvic bone were secondary sarcomatous evolutions of benign chondromas.

Despite early failures, the procedure has gained more recognition in recent years, with a present mortality rate of approximately 15 per cent. Modern anesthesia, blood restitution, and antibiotics have greatly extended the field of this extensive type surgery. The indications for such a radical operation will always be limited. Most of the procedures have been done for malignant tumors affecting the proximal portion of the thigh, hip, or innominate bone so that removal by hip joint disarticulation was impossible. The prognosis will depend on the anatomic type and extent of the tumor, the number of recurrences prior to surgical intervention, and the presence of distant metastases. The procedure should not be withheld from any patient whose only chance of survival lies in its performance.

CASE REPORT

A 34-year-old Air Force pilot was admitted to this hospital 24 October 1955 complaining of pain and stiffness in the right hip. In December 1954, he spontaneously developed pain in the hip region. There was no antecedent history of injury. Pain persisted for three weeks after which he reported to his local base hospital where a diagnosis of arthritis of the hip was made and an extensive course of physical therapy, including diathermy, given. The pain became more intense with further limitation of motion, and the patient was transferred to another hospital. Roentgenograms of the hip at this time revealed no evidence of bone or joint disease. On 31 March 1955, arthrotomy of the joint was performed with partial excision of the synovium and anterior capsule. Clinical impression, substantiated by the pathologist's reports, was synovial chondromatosis. The wound healed uneventfully and after a course of physical therapy, the officer was discharged to duty 21 April. Upon return to flying status, he served a period of temporary duty in North Africa and again developed pain and stiffness in the involved hip to the extent that he could no longer fly.

Evaluation at his local base hospital 15 October revealed virtual ankylosis of the hip with severe pain upon weight-bearing, and roentgenograms showed periarticular amorphous calcification about the hip joint (fig. 1). In the 10-month period following initial onset of symptoms, the patient had lost 15 to 20 pounds, even though his appetite remained good. He was referred to this hospital for hip fusion. Past history was noncontributory with no episode of specific trauma nor infectious disease process relative to the hip.

Physical examination revealed a well-developed and well-nourished male in no acute distress except when attempting to bear weight on the right hip. He could not walk unsupported without intense pain in the hip joint. The head, neck, upper extremities, chest, and abdomen showed no significant findings. He stood with the pelvis tilted forward on the right and a compensatory lordosis and scoliosis of the lumbar region. A 20° flexion contracture was present in the right hip with no demonstrable flexion, extension, abduction, adduction, or rotation movements. Spasm of the adductor musculature was present with 1-inch atrophy of the thigh and 1½-inch atrophy of the calf. A well-healed, nontender, 8-inch surgical scar was present over the anterior aspect of the right hip, with a 2-cm, nontender mass palpable beneath the upper aspect of the old scar. Neurologic examination was negative, and circulation in the right lower extremity normal.

Admission laboratory work revealed a normal blood count and urinalysis. The sedimentation rate was elevated to 35 mm. The blood alkaline phosphatase was reported as 7.4 King and Armstrong units. A roentgenogram of the chest was negative. A roentgenogram of the right hip revealed a large amount of granular calcareous debris within

and about the joint and demineralization of the head and neck of the femur (fig. 1). Review of roentgenograms taken March 1955 showed no significant findings relative to the involved hip.

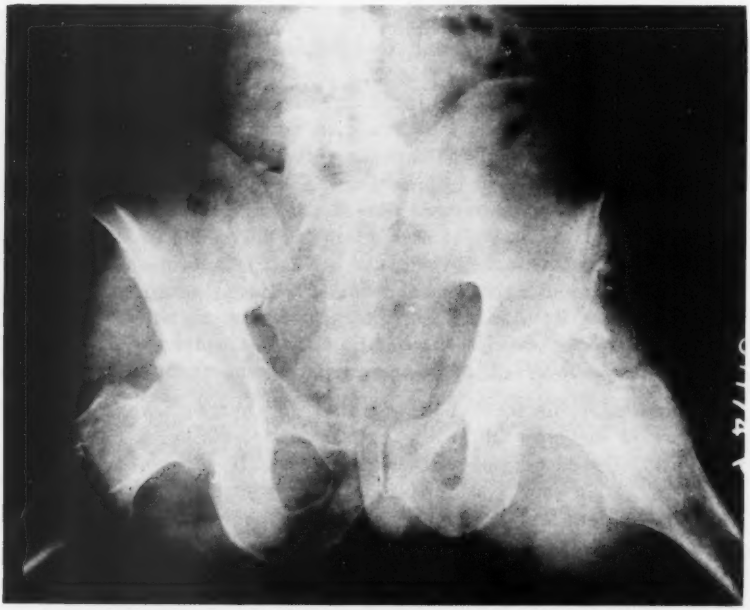


Figure 1. Roentgenogram, October 1955, showing granular calcareous material within and about right hip joint with demineralization of head and neck of femur.

Initial clinical impression was a recurrence of the pre-existing synovial chondromatosis. The patient was placed at bed rest in traction for relief of pain. In view of the virtual ankylosis of the hip and severe pain upon attempted motion and weight-bearing, it was believed that another arthrotomy and joint cleansing procedure should be performed.

On 14 November 1955, a posterior approach to the hip was made with excision of diseased synovium and adjacent tissues with a large amount of soft, friable, and calcareous material. The head and neck of the femur and the acetabulum did not appear to be involved. The mass present in the upper part of the old incision was also excised. The patient was kept in bed with balanced suspension while the wound healed.

The local pathologist's report was chondrosarcoma, both of the tissues removed from the hip joint and the mass from the old incision. The sections revealed neoplastic cartilage with marked pleomorphism of the nuclei, pyknotic nuclei, and marked variation in size of the

nuclei (fig. 2). The nests of cartilaginous tissue were separated by dense fibrous connective tissue. The impression of chondrosarcoma was later confirmed by the Armed Forces Institute of Pathology, Washington, D. C. In view of these findings, the case was presented to the hospital tumor board which concurred with the recommendation that a hindquarter amputation be performed as the only possible treatment for the relief and/or eradication of this disease.

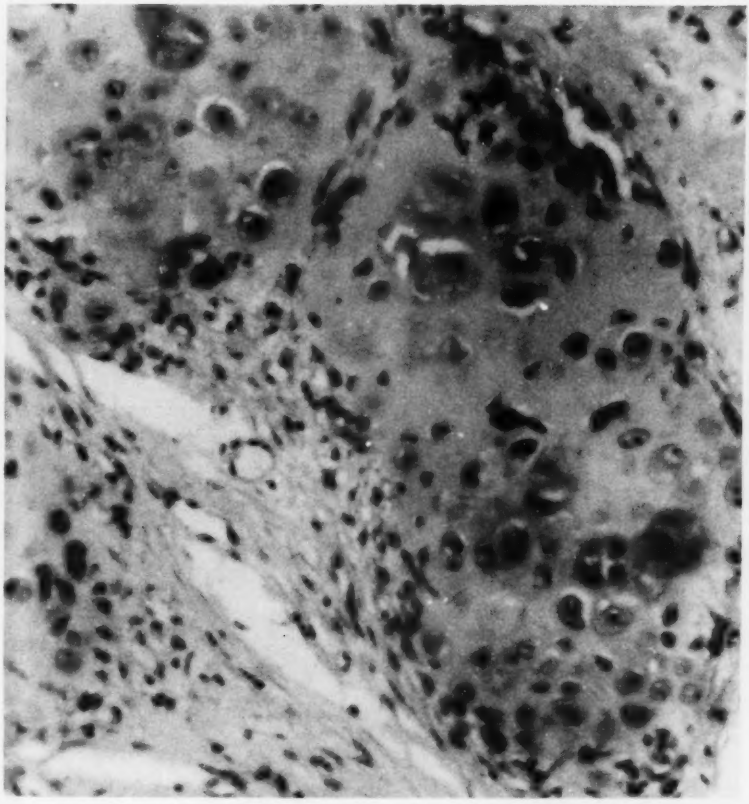


Figure 2. Biopsy specimen showing characteristics of chondrosarcoma. Note the binucleate cartilage cells and large hyperchromatic nuclei. (× 264)

The patient finally submitted to surgical intervention 29 December, when the entire right lower extremity with the adjacent innominate bone was removed through the sacroiliac and pubic joints. The procedure was performed under general hypotensive anesthesia with the patient in the lateral position, and the operating time was 100 minutes. The anterior and posterior portions of the dissection were carried out simultaneously

with two teams, and the operative technic described by King and Steelquist[13] was essentially followed. Two tissue drains were laid in the extraperitoneal space and brought out at each end of the wound after closure of the posterior flap (fig. 3). A Foley catheter was in place during the operation and connected to a tidal drainage system after return to the recovery ward. The patient tolerated the extensive procedure without event, having been supported with a transfusion of

Figure 3. Postoperative photograph, showing posterior skin flap and tissue drains.

2,500 ml of blood. At the time of surgery the tumor had extended about the hip region and through the obturator foramen into the pelvis; there were discrete nodules in the old posterior and anterior scars (figs. 4 and 5).

The postoperative course was smooth except for the usual phantom type pain in the stump area. Wangensteen suction was used to combat bowel distention during the first 24-hour period, after which oral alimentation was resumed. The drains were removed 48 hours postoperatively. Antibiotics were given until wound healing was assured. Except for a small superficial necrotic area in the superior portion of the flap, the wound healed well. This defect was later corrected by advancing an abdominal flap. Two weeks after the operation, the patient was up and about on crutches and undergoing rehabilitation in physical therapy (figs. 6 and 7). His appetite was good and he had no interference with bladder or bowel function. He had considerable relief of the previous pain.

Figure 4. Neoplastic cartilaginous cells with interspersion of fibrous tissue. (× 60)

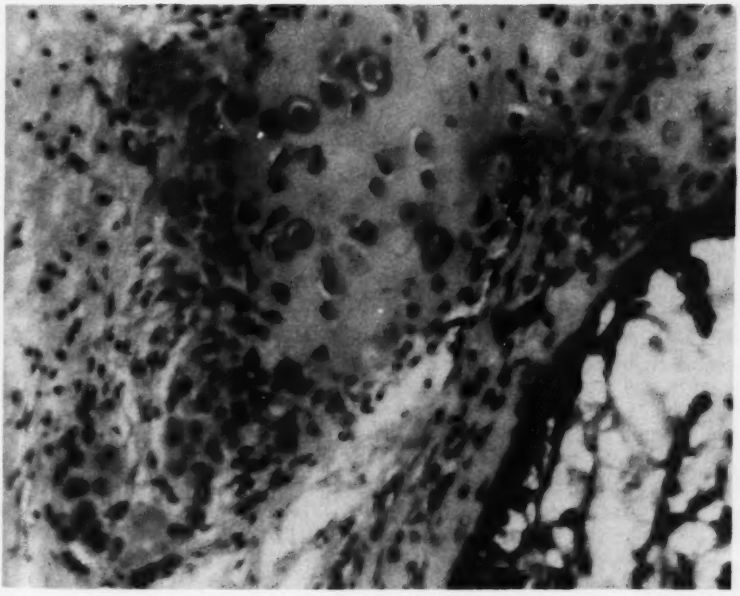
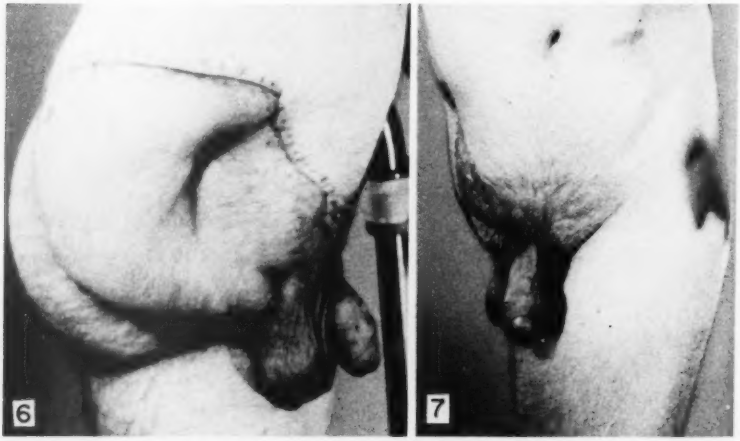


Figure 5. Nest of malignant cells exhibiting pleomorphism. The nuclei of the cartilaginous tissue show marked variation in size. (× 264)

The patient went home on convalescent leave and did well until 3 April 1956, when a roentgenogram of the chest first revealed evidence of pulmonary metastases. During the next two months he developed progressively intense pain in the pelvis, right-sided headaches, and some discomfort in the chest upon deep inspiration. He developed haziness of vision in his right eye and palpable nodules in the right portion of his scalp. Roentgenograms in July revealed destruction of the sacrum, and both lung fields were heavily infiltrated with snowball metastases. He ran a rapidly downhill course with progression of symptoms relative to the pelvis, chest, right eye, and scalp, during



Figures 6 and 7. The healed posterior flap two months after amputation.

which period the intense pain was controlled with spinal injections of absolute alcohol, heavy opiates, and inhalation of Trilene (brand of trichloroethylene). The patient lapsed into a semicomatose condition and died during sleep 26 August, some 20 months after initial onset of symptoms.

The final clinical diagnosis was chondrosarcoma of the right hip, probably secondary to synovial chondromatosis.

Autopsy was performed 26 August, and the gross anatomical findings were: (1) chondrosarcoma of right hip with extensive metastases; (2) pulmonary chondrosarcomatosis with metastatic chondrosarcoma of ribs; (3) epidural metastatic chondrosarcoma, spinal and cranial; and (4) metastatic chondrosarcoma to the tissues between the scalp and skull.

DISCUSSION

Unfortunately there was a time lapse of some 12 months between the onset of symptoms and hindquarter amputation in this

case. Although the initial diagnosis was synovial chondromatosis there may be a question of early malignant transformation at this time. Certainly it is essential that an early and accurate diagnosis be made in these cases in order that radical surgery may be carried out as soon as possible. There should be a fair chance for survival if the lesion has not spread locally beyond the bounds of operation and if there is no evidence clinically or roentgenographically of metastases.

It is well known that patients who have gone on without surgical treatment have experienced excruciating pain, difficult to relieve by any measure. Consequently, we consider it justifiable to perform this mutilating procedure for palliative reasons alone. Case reports from the literature show that life can still be enjoyed without intractable pain, and even a satisfactory prosthesis may be fitted to enable ambulation without crutches. Our patient was ambulatory on crutches two weeks after the amputation with nearly complete pain relief. He continued to lead a virtually normal and pain-free existence until the unhappy evidence of widespread metastases and their effects four months after operation.

The technic of operation has become fairly well standardized and the following points are mentioned only for re-emphasis. Psychologic preparation of the patient and his family for this extensive procedure is obviously important. Prior to the operation the bowel is prepared with neomycin sulfate medication and a cleansing enema, and systemic antibiotic therapy is instituted. A Foley catheter is connected to a tidal drainage system after the procedure. Adequate blood supplies must be available and a transfusion is started before the incision is made. In order to minimize the risk of shock, the patient is moved as little as possible during the operation. Once our patient was placed in the lateral position and supported by sandbags and pillows, very little rotation was required to perform the dissection. A general anesthesia with induced hypotension was found highly satisfactory in our case and the length of operation was cut considerably with two surgeons performing the anterior and posterior dissections simultaneously. However, it should be mentioned that with good supportive treatment and good anesthesia there is no great necessity for a hastily performed procedure and the possibility of rough handling of tissues and subsequent wound complications.

A large posterior flap was fashioned without the retention of the gluteus maximus muscle, since it was thought that this muscle was possibly involved by disease. The flap healed well and there was no problem of herniation of the unsupported abdominal

viscera. Tissue drains left at either end of the incision were removed in 48 hours and postoperative Wangensteen suction was instituted to relieve bowel distention. Oral feeding and ambulation of the patient was encouraged as soon as possible. Systemic antibiotics were continued until wound healing was assured.

SUMMARY

A case of chondrosarcoma of the hip with hindquarter amputation is presented, together with a survey of the literature. The important points in the operative technic and the management of the patient are discussed. Even though this extensive operation is performed in the hope of a cure, we believe that it is justifiable as a palliative measure alone.

ACKNOWLEDGMENT: We are grateful to Doctor William A. Quijano, Lackland Air Force Hospital, for the photographic illustrations.

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Thoughts on the Ellis-van Creveld Syndrome

Report of an Analogous Case

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FOR A SYNDROME to deserve a place in medical terminology, it must usefully correlate a set of anatomic, etiologic, or functional phenomena. Grouping together as a nosological entity independent variables that occur simultaneously only by chance serves no purpose. It is well, therefore, to review an established syndrome occasionally and affirm its right to a distinctive name. The appearance in our clinic of a girl with multiple congenital anomalies has directed us to a reconsideration of the Ellis-van Creveld syndrome.

This syndrome, known also as chondroectodermal dysplasia (dwarfism; dysplasia of certain epiphyseal centers, teeth, and nails; and polydactylism), has been definitely identified in 11 patients;[1-8] in 9, congenital heart disease was present. Other cases have been reported,[9-14] but either they are not truly representative of the syndrome, or they are not described in sufficient detail to enable the diagnosis to be confirmed from the reports alone.

The earliest descriptions of the disease favored accepting heart disease as an integral part of the syndrome. Caffey,[4] however, pointed out that the only true distinguishing abnormalities were maldevelopment of certain epiphyseal centers, notably those of the proximal tibias and of the carpal bones, presence of an extra digit, and shortening of the distal long bones. Gellis[15] expressed a point of view even further removed from that of the physicians who first described the syndrome. He did not fully accept the group of malformations as representing a valid and unique syndrome, and pointed out that the Ellis-van Creveld syndrome could represent only fortuitous occurrence of isolated developmental defects otherwise seen alone or in smaller groupings.

When we recently saw a 9-year-old girl with dwarfism, bony deformities, dysplasia and aplasia of the teeth, mongoloid facies, and pseudotruncus ateriosus, we thought at first that she represented a variant of the Ellis-van Creveld syndrome. Study re-

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vealed that the child was in fact a curious combination of inherited and acquired abnormalities that made her but a counterfeit of the syndrome. Her case is reported not only for its own interest but also because it may serve as an example of the way in which inherited traits can be overlaid with defects acquired during intra-uterine and extra-uterine life and the resultant become known as a syndrome—if the same chain of circumstances happens by chance three times.

CASE REPORT

The patient was born on 13 November 1947, the daughter of healthy young parents with no history of consanguinity. Prenatal development had been complicated by the appearance of progressive polyhydramnios beginning at the fifth month of gestation. Delivery was by low forceps, three days after rupture of the fetal membranes.

Immediately after the child's birth, the attending physician noted cyanosis, a hemangioma of the forehead, and extremely short arms and legs. Inquiry revealed that a maternal aunt had short arms and that the hemangioma had been present in at least four successive generations on the maternal side of the family. There was no family history of diabetes, syphilis, or of any other developmental abnormalities, but there was a marked history of allergy.

From 1948 to 1951 the patient was seen annually at the Johns Hopkins Hospital by Drs. Harriet G. Guild and Helen Taussig. A diagnosis of truncus arteriosus with left aortic arch was made; chondrodystrophy was also considered, but as follow-up roentgenograms revealed no abnormality, this possibility was discarded. Pertinent physical findings during those years were short stature, cyanosis, and a soft, blowing, systolic murmur heard over the precordium. The hematocrit was 55 ml per 100 ml. Roentgenograms of the chest were compatible with the diagnosis of truncus arteriosus. Electrocardiographic findings were consistent with right ventricular hypertrophy.

Cardiac catheterization was performed in 1952 at the U. S. Naval Hospital, Bethesda, Md., following consultation at this school. Because atrioventricular dissociation developed, the catheterization had to be terminated and studies are incomplete. The following data were obtained: right ventricular pressure, 100/0 mm Hg; superior vena cava oxygen saturation, 13.6 ml per 100 ml; right ventricle, 11.4 ml per 100 ml. The truncus could not be entered.

Angiocardiography demonstrated flow of the contrast medium from right atrium to right ventricle and thence to a large truncus. Some contrast medium flowed from the right ventricle into the lung fields, perhaps signifying a small pulmonary artery. Large retroesophageal collateral bronchial arteries were demonstrable. The questionable presence of a pulmonary artery resulted in a change of diagnosis to that of pseudotruncus arteriosus.

Multiple dental extractions were performed in 1954 for relief of caries and periapical granulomata and abscesses.

The patient was examined for the second time at this school in 1956. She was 9 years old and in the 20th centile for weight (25.2 kg, 55.5 lb) and under the 3d centile for height (120 cm, 47.2 in.). Her arms and legs were short in proportion to the trunk (fig. 1), and there was limitation of radial deviation of the wrists. The forehead was prominent, the nose broad and flat, and the epicanthal folds distinct. A large bluish capillary hemangioma was present in the middle of her

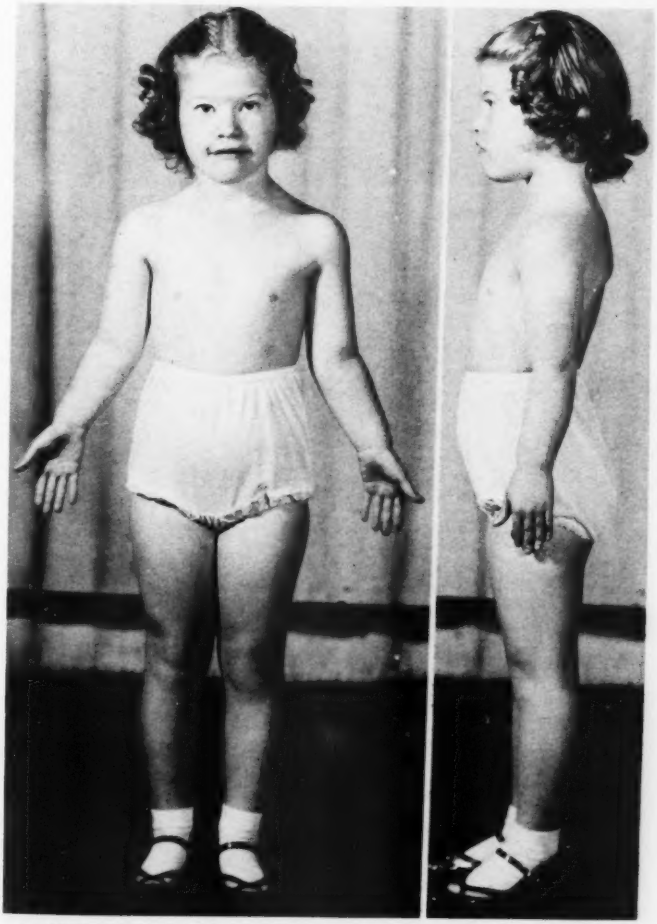

Figure 1. Photographs of the patient at nine years. Relative shortness of the forearms and clubbing are apparent. The mongoloid facies and frontal hemangioma are not so striking in the picture as they are in life.

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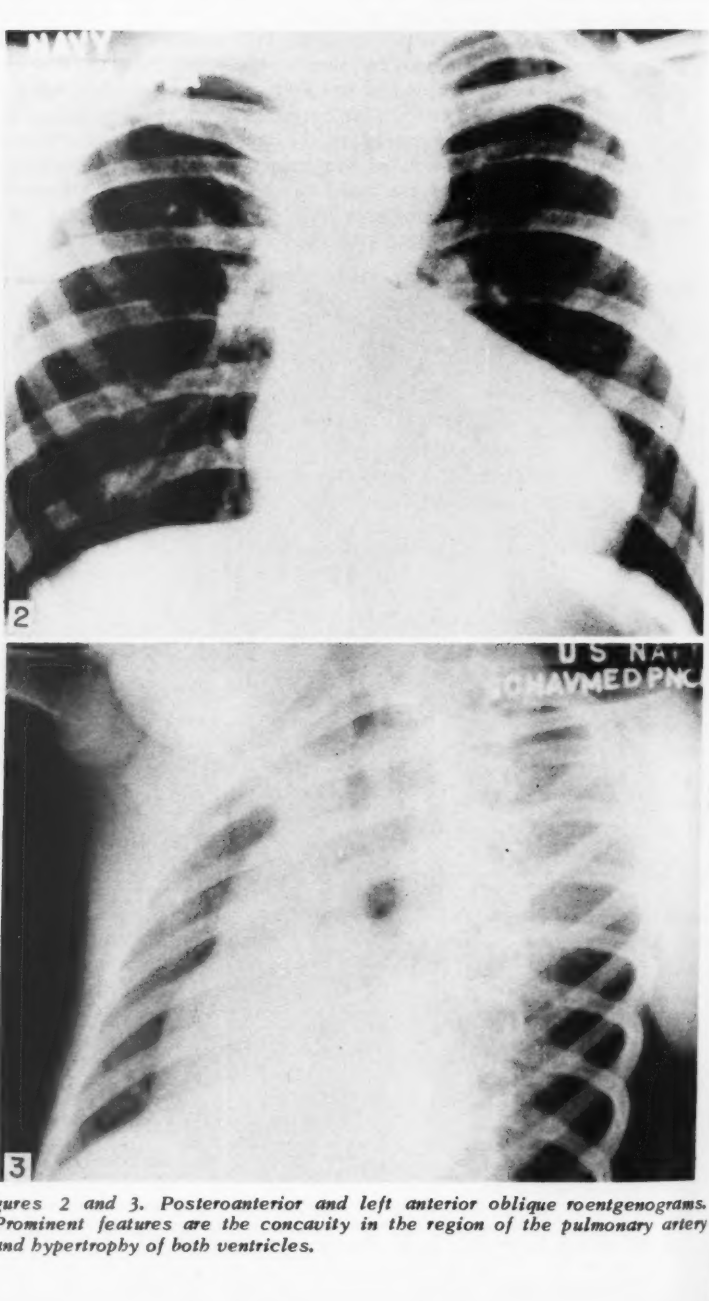


Figures 2 and 3. Posteroanterior and left anterior oblique roentgenograms. Prominent features are the concavity in the region of the pulmonary artery and hypertrophy of both ventricles.

brow. Funduscopic examination revealed no abnormality. A few permanent teeth were present, but these were malformed and carious. The substance of the nails and hair appeared normal, and the thyroid gland was of normal size.

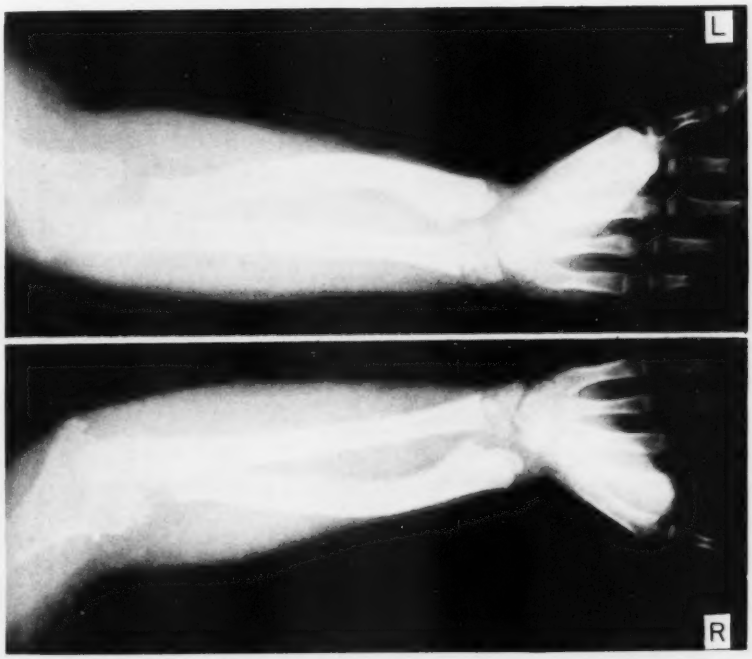
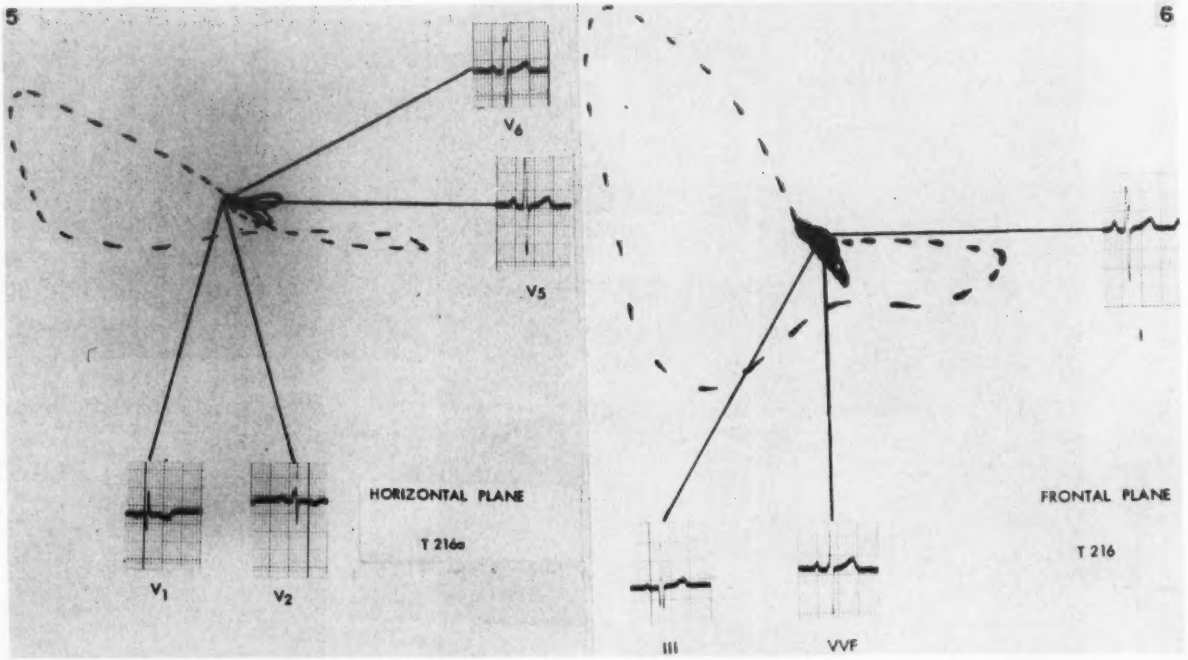


Figure 4. The ulnar obliquity of the distal radius, imperfect radiocarpal articulation, bowed radius, and short bones of the forearms are characteristic of Madelung's deformity.

The patient's chest was symmetrical. Her lips and nail beds were cyanotic, her nails clubbed. The peripheral pulses were full and synchronous. Blood pressure in the arms was 90/60 mm Hg. Her heart was slightly enlarged to percussion; no thrills were present. A somewhat harsh, grade 3 systolic murmur was heard over the precordium, neck, and back, with maximal intensity at the second and third left intercostal space midway between the left sternal border and midclavicular line. At the point of maximal intensity, a soft, blowing diastolic component also was heard. The lungs, abdomen, and genitalia were normal. Laryngoscopic examination showed that the right vocal cord moved somewhat more sluggishly than did the left.

The hematocrit was 58.5 ml per 100 ml. Calcium, phosphorus, alkaline phosphatase, protein-bound iodine, and cholesterol levels were normal.



Figures 5 and 6. Loops representing the vectorcardiogram in the horizontal and frontal planes and the representation of their axial projections as conventional electrocardiograms. Right ventricular hypertrophy dominates the tracings, but the wide QRS-T angle is clearly seen in the horizontal plane.

Roentgenograms for cardiac configuration (figs. 2 and 3) showed the presence of right and left ventricular hypertrophy and retroesophageal blood vessels. A concavity was present in the region of the pulmonary artery; no "shelf" was seen in the left anterior oblique view. Pulmonary vascular markings were slightly less prominent than normal. Full-mouth films showed the absence of buds for both upper lateral incisors. All other teeth were present, but most were unerupted. Roentgenograms of the forearm were diagnostic of Madelung's deformity (fig. 4). Other long bones were not abnormal. The bone age was about 6 ½ years.

Conventional electrocardiograms were indicative of right ventricular and atrial hypertrophy. The loop representing the vectorcardiogram was a classical example of findings in right ventricular hypertrophy (figs. 5 and 6).

On the Stanford-Binet scale the IQ was 102.

COMMENTS

The clearly inherited traits in this case are the frontal hemangioma and Madelung's deformity. The relation of the hemangioma to the rest of the patient's disease is ill-defined. Madelung's deformity has been shown to be a dominant characteristic;[16] in this case, the patient's maternal grandaunt probably also had the deformity. On this background of heredity is superimposed a pattern of delayed growth secondary to congenital cyanotic heart disease, yielding in combination the picture of a malformed dwarf.

The contribution of intra-uterine life to the composition was pseudotruncus arteriosus. Whether a primarily blighted ovum evoked polyhydramnios, or whether a maternal abnormality manifested by polyhydramnios resulted in congenital heart disease is a matter for conjecture.

Between these two rather definite extremes of nature and nurture lies the ectodermal dysplasia. In its most obvious form, ectodermal dysplasia results in absence of many teeth, deformity of those present, maldeveloped fingernails and hair, and defects in the growth of the facial bones; for the most part the disease is sporadic. In this case, the dysplasia is in evidence by absence of two toothbuds, alleged defect in the quality of the enamel of the deciduous teeth and perhaps, in association with a mesodermal defect, also by the broad flat nose, prominent forehead, and epicanthal folds suggesting mongolism.

Comparison of this case with examples of the Ellis-van Creveld syndrome reveals some obvious parallels. Each has a well-known hereditary component—in one case, Madelung's deformity, in the other, polydactylism. Each has a factor of sporadic occurrence: namely, ectodermal dysplasia. Each has a form of dwarf-

ism. In our case the dwarfism is probably subsequent to lifelong hypoxemia; in the Ellis-van Creveld syndrome its etiology is not known, but it is likely that it is related to the epiphyseal-diaphyseal dysplasia. The congenital heart disease common to the two diseases is both statistically and inductively a product of intra-uterine existence.

As a result of these comparisons, it seems that Gellis' view of the Ellis-van Creveld syndrome has much merit. The syndrome could be explained by chance occurrence of unrelated factors as in our case. On the other hand, the unique skeletal deformities delineated by Caffey are constant phenomena in the well-documented cases of the syndrome, and there is some evidence that a recessive gene is responsible for the chondroectodermal dysplasia.[13] Thus, if a syndrome does exist, it seems logical to restrict the definitive characteristics to lesions of bone, and perhaps also of ectoderm as Caffey has done, and place the element of congenital heart disease in the background.

SUMMARY

The case of a 9-year-old girl with dwarfism, Madelung's deformity, partial ectodermal dysplasia, and pseudotruncus arteriosus is presented to show how genetically determined traits were intermixed with acquired traits to yield the final clinical picture. Comparison is made with cases of the Ellis-van Creveld syndrome. Certain similarities which are noted lead to the proposal that the definitive elements of the Ellis-van Creveld syndrome be limited to manifestations of chondroectodermal dysplasia, and that the congenital heart disease usually present be regarded merely as an accessory abnormality.

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NATURAL HISTORY OF HERPES ZOSTER

"The course of herpes zoster was studied in a series of 206 patients that included infants and octogenarians. There were 32 patients under the age of 20; in 30 of these (94 per cent) the condition cleared up in 14 days or less. The infection was more severe and prolonged in older patients. In four elderly patients symptoms persisted six months or longer. The relative frequency with which the various parts of the nervous system were involved varied from youth to old age. No instance of involvement of the ophthalmic division of the trigeminal nerve was observed in patients under the age of 20, but ocular complications did not appear to be related to the aging process. Postherpetic neuralgia did not occur in patients under 20 but was frequent in patients over 50. Sex, race, and season did not perceptibly influence the incidence of infection in this series."

—CARROLL F. BURGOON, Jr., M. D.,
JANE S. BURGOON, M. D.,
G. DOUGLAS BALDRIDGE, M. D.
in *Journal of the American Medical Association*
p. 265, May 18, 1957

Departments

A MESSAGE FROM THE A. M. A.

In its present form, Asian influenza, caused by a new virus mutant, is only temporarily disabling. Even so, it could strike enough military personnel to cause serious disorganization in our military departments, at least on a short-term basis. Sensitive to epidemic implications, the U. S. Armed Forces medical service sent specimens of the virus from the Far East last April to the Walter Reed Army Research Center in Washington, D. C., for typing. More recently, with indications of a probable epidemic outbreak of the disease in this country, a determination was made to vaccinate military personnel, since the disease is highly contagious and spreads very rapidly. Arrangements have been made with the manufacturers of the vaccine to earmark part of their output for military use.

The American Medical Association, in co-operation with the Public Health Service, has launched a nation wide preparedness program to combat an outbreak of Asian influenza among the civilian population in this country. The A. M. A. Board of Trustees, in July, designated its Committee on Civil Defense, Council on National Defense, as a Special Committee on Influenza to implement a program of action designed to mobilize medical manpower and institute other precautionary measures to cope with any influenza outbreak this fall and winter.

The A. M. A. program consists of an informational and an operational phase. The informational phase got under way on 26 July, when packets of material on Asian flu were sent to members of the A. M. A. House of Delegates, presidents of state medical societies, secretaries of county medical societies, and chairmen of state emergency medical service committees. National allied health and medical associations have been urged to assist and co-operate and to ask their constituent bodies to join with local medical societies in formulating plans for co-operative efforts.

For the past two months, a series of articles has been published in the *Journal of the American Medical Association* covering historical and scientific aspects of the disease, together with reported and confirmed incidence rates being tabulated by the Public Health Service. Articles have also appeared in

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From the Council on National Defense of the American Medical Association. The views and opinions expressed are not necessarily those of the Department of Defense. —*Editor.*

Today's Health providing information as to what the general public should expect and what to do. If and when the epidemic becomes nation wide in scope, A. M. A. representatives will be put on network television and radio programs to provide the public with information on home care and precautionary measures.

In its operational program, the Association has informed state and county medical societies of the possible impact of an influenza epidemic on normal professional services and facilities. The Special Committee on Influenza has continued to urge local medical societies to develop adequate stand-by programs and plans to cope with the problem. State emergency medical service committees have been alerted to institute precautionary measures and to see that proper organizational plans are co-ordinated and readied in each state medical society. The Committee suggested that consideration should be given to expanded professional care through the utilization of all physicians, regardless of type of practice. Local plans should include mobilization of other professional resources, such as nurses, nurses' aides, pharmacists, and others. Action to make full use of hospital facilities should be explored, such as curtailment of elective surgery and diagnostic studies. It is essential that state and local programs be closely co-ordinated with public health agencies and state and local health departments.

The Committee has been particularly impressed with the prompt attention and serious consideration which this problem is receiving at state and county levels. Within three weeks after the Association pledged its support and participation in a plan to alert the nation's practicing physicians to the dangers of a possible influenza outbreak, many state and county medical societies reported the programs they had set up and the enthusiastic response which was being given by individual physician members.

Dr. David B. Allman, A. M. A. President, Atlantic City, at the time the program was instituted said, "The epidemic may not strike in this country, but the American Medical Association is anxious to have practicing physicians mobilized and alerted in case an outbreak does occur. Thousands of persons have been stricken with the disease in the Far East, and it is only good medicine to deal in probabilities now, when we have the time. In that way, the American people will be best served from a medical standpoint."

AMERICAN PUBLIC HEALTH ASSOCIATION TO MEET IN CLEVELAND

The 85th annual meeting of the American Public Health Association and meetings of some 40 related organizations will be held in the Cleveland Public Auditorium, Cleveland, Ohio, from 11 to 15 November, 1957. In addition to the presentation of a large number of papers, there will be many technical exhibits. This year's APHA meeting will include many research reports on subjects related to the maintenance of a healthful environment and an aggressive attack on disease and disability. Of about 400 scientific papers to be presented in 75 sessions, more than half will concern research accomplishments or opportunities.

Considerable interest will center around a session on radiation protection, which is scheduled for Wednesday morning. The session will include a symposium on current status in setting radiation exposure standards; a scientific paper on community health problems due to peacetime uses of radiation, to be presented by Roy J. Morton, associate director of the radioactive waste disposal research project at Oak Ridge National Laboratory and president-elect of the association; and a paper on program planning for radiation protection, to be presented by Dr. Herman E. Hilleboe, New York State health commissioner, and Alexander Rihm, Jr., chief of the radiological health section of the New York State Department of Health.

Another session of timely interest will be a panel discussion on influenza, including epidemiology, status of vaccine production and utilization, control measures, and laboratory services. This session is scheduled for Thursday morning.

Other topics will include: health implications of new food and milk processes, including use of chemicals and antibiotics, freezing, and irradiation; the effects of housing quality on morbidity; food implications of changes in the American pattern of diet; and developments in mental health, including school and community programs and new programs for retarded children.

There also will be discussion of new research implications for detection and measurement of air pollution; developments in sanitary control of drinking fountains, home swimming pools, hotels, motels, and tourist homes; and technical developments in fluoridation, including experience in maintaining constant fluoride concentrations and possibilities for fluoridating individual water supplies.

The problems of habituating drugs in industry; development and testing of new chemicals to combat cancer; statistical studies on perinatal mortality, prematurity, and the epidemiology of cancer and other diseases; and new patterns of medical care programs in hospitals and elsewhere will be covered.

Four general sessions are scheduled. On Monday morning, prominent national leaders will take part in a symposium on public policy aspects of public health planning. Tuesday evening's session will feature addresses by the Association's president, Dr. John W. Knutson, assistant surgeon general and chief dental officer of the U. S. Public Health Service, and Dr. Lowell J. Reed, president emeritus of Johns Hopkins University. The Sedgwick Memorial Medal will be presented at this session. Lasker Awards of the American Public Health Association for 1957 will be presented Thursday evening. A closing symposium Friday afternoon will focus on public health priorities for 1958.

DEATHS

ELLENBERGER, William, Captain, DC, USNR, of Milwaukee, Wis.; stationed at the U. S. Naval Air Station, Willow Grove, Pa.; graduated in 1925 from Marquette University Dental School, Milwaukee, Wis.; appointed a Lieutenant in the United States Naval Reserve 1 June 1943; ordered to active duty 11 August 1943; died 6 July 1957, age 55, at Hatboro, Pa., of arteriosclerotic heart disease.

HATCHER, Dock Thomas, Jr., Lieutenant, MC, USN, of Butler, Mo.; stationed at the U. S. Naval Air Station, Glynco, Brunswick, Ga.; graduated in 1950 from the Baylor University College of Medicine, Houston, Tex.; served in an enlisted status in the United States Naval Reserve, on active duty, 1 March 1944 to 26 October 1945; appointed a First Lieutenant in the Army of the United States 9 September 1952, resigning 30 September 1954; appointed a Lieutenant in the United States Navy 19 May 1955; died 6 July 1957, age 30, at the U. S. Naval Air Station, Glynco, Ga., by drowning.

MEYERS, Doris Ann, First Lieutenant, USAFR (NC), of St. Petersburg, Fla.; stationed at the 3920th USAF Dispensary, 3920th Air Base Group, APO 147, New York, N. Y.; graduated in 1953 from the Charity Hospital of Louisiana School of Nursing, New Orleans, La.; appointed a Second Lieutenant in the United States Air Force Reserve 12 December 1954; ordered to active duty 20 February 1955; died 27 July 1957, age 24, at the Cheltenham General Hospital, Cheltenham, Gloucestershire, England, as the result of an automobile accident.

OFFICERS CERTIFIED BY SPECIALTY BOARDS

Supplementary Listing

According to information from the Offices of the Surgeons General of the military medical services, the following regular Medical Corps officers have been certified by the boards indicated since the listings published in previous issues of this *Journal*.

American Board of Psychiatry and Neurology

Psychiatry

Leonard J. Wiedershine, Lt. Col., USAF

American Board of Orthopaedic Surgery

William C. Cantrell, Capt., USN

American Board of Dermatology and Syphilology

Judson H. Jenkins, Comdr., USN

American Board of Urology

Charles W. Lewis, Jr., Comdr., USN

American Board of Obstetrics and Gynecology

Charles F. Climie, Jr., Comdr., USN
Quincy E. Fortier, Maj., USAF
Deane E. McLeod, Lt. Comdr., USN
Vernon J. Merkle, Lt. Comdr., USN
Frank Ostapowicz, Lt. Comdr., USN
Kenneth N. Owens, Maj., USA
Daniel M. Shook, Comdr., USN
DeWitt S. True, Comdr., USN
Peter F. Wells, II, Lt. Comdr., USN
Walter M. Wolfe, Lt. Col., USA

American Board of Internal Medicine

Lay M. Fox, Lt. Comdr., USN
Rodney R. Gleysteen, Capt., USN

American Board of Ophthalmology

Richard E. Lieurance, Comdr., USN

American Board of Surgery

Harry P. Mahin, Comdr., USN
Janice A. Mendelson, Capt., USA

American Board of Neurological Surgery

Robert A. Mendelsohn, Maj., USAF

American Board of Preventive Medicine

Aviation Medicine

Donald M. Alderson, Col., USAF
Charles H. Bramlitt, Col. USAF
Paul W. Musgrave, Maj., USAF
Don P. Peters, Lt. Col., USAF

AVIATION MEDICINE—Continued

Norman I. Condit, Maj., USAF
Charles E. Cook, Jr., Maj., USAF
Donald M. Kennett, Lt. Col., USAF
John P. McCann, Maj., USAF
Voris F. McFall, Col., USAF
Charles H. Roadman, Col., USAF
Robert E. Robards, Maj., USAF
George E. Schafer, Lt. Col., USAF
Robert B. Stonehill, Maj., USAF
William W. Thompson, Maj., USAF

Founders Group in Occupational Medicine

John E. Boysen, Col., USAF
Robert T. P. DeTreveille, Maj., USAF
John S. Gruggel, Capt., USN

REHABILITATION AND EMPLOYMENT OF THE PHYSICALLY HANDICAPPED

Members of the Armed Forces have a special interest in the activities of The President's Committee on Employment of the Physically Handicapped, which will reach a peak in National Employ the Handicapped Week during 6 to 12 October. The following message from President Eisenhower evinces his concern for the furtherance of such employment.

There is one basic thing to remember about hiring workers who are physically handicapped. It is good business to hire them—good for the nation and good for the person. It makes an earner out of an American who would otherwise be relatively helpless. I would like to congratulate the citizens who understand this and are helping to promote the widespread use of handicapped workers.

Now we must tell others about the value of employing the physically handicapped because two million Americans with physical handicaps are still waiting to be used. Two million Americans could enter the labor force today if they were properly prepared and equipped to do so.

I urge all employers, therefore, to use the handicapped wherever possible. I urge all workers to accept their handicapped fellow Americans as their coworkers. In these demanding times the labor force of our nation is our most precious asset. Working shoulder to shoulder, the handicapped can add spirit and power to America as we seek to promote the strength of the whole free world.

SIX MEDICAL CORPS OFFICERS SELECTED FOR GENERAL OFFICER AND FLAG RANKS

Five Army and Air Force Medical Corps officers holding important professional assignments have been promoted recently to general officer and a Navy captain has been selected for rear admiral. The new Army general officers are Brigadier Generals Thomas J. Hartford, MC, USA, deputy commanding general of Walter Reed Army Medical Center, James C. Forsee, deputy commanding general of Walter Reed Army Hospital, and Carl W. Tempel, commanding general of Valley

General Hartford

General Forsee

General Tempel

Captain Kenney

General Brownton

General Cullen

Forge Army Hospital, near Philadelphia. The Navy selected for promotion Captain Edward C. Kenney, MC, USN, who was decorated for "extraordinary heroism" at Guadalcanal and now commands the U. S. Naval Hospital, Bethesda, Md. Two Air Force flight surgeons advanced to brigadier general are Sheldon S. Brownton, director of the staff in the office of Assistant Secretary of Defense Frank B. Berry, and John K. Cullen, director of plans and hospitals in the office of Major General Dan C. Ogle, surgeon general of the Air Force.

Reviews of Recent Books

WORLD-ATLAS OF EPIDEMIC DISEASES, Part III, First of four issues, edited by Professor Dr. med. *Ernst Rodenwaldt* and Privatdozent Dr. med. habil. *Helmut J. Jusatz*, Heidelberg, under the sponsorship of the Heidelberger Akademie Der Wissenschaften. 36 pages; 10 colored maps; in hard back binder, 15½ by 19 inches in size, loose-leaf, with three brass screw posts, of size suitable for insertion of forthcoming second, third, and fourth issues. Valk-Verlag, Hamburg 1, Germany, 1957. Price DM 75, plus extra charge for postage and packing.

This first issue of Part III of this world atlas provides continuation of the geomedical presentation of epidemic diseases. Parts I and II have been reviewed in previous issues of the *U. S. Armed Forces Medical Journal.* This volume contains descriptive sections and color maps pertaining to the following topics: brucellosis in Europe; rabies, schistosomiasis in Africa; plague, leishmaniasis and filariasis in the Americas; yellow fever and schistosomiasis in South America. Also included are recent (1949-1954) data on the composition and distribution of populations in South and Central America.

In these days of rapid global travel, these atlases provide a valuable addition to the literature on geomedicine. Differing from those books which provide the reader a summary of all diseases of importance in a particular area or country, the approach of the atlas is to present a more detailed description of a single disease on a continental or multicontinental basis. Notable features in relation to the zoonoses are the tabulations and distribution mapping of potential animal hosts and vectors with adequate reference to sources of information.

The descriptive summaries are concise and defined within the span of years. As witnessed by the section on yellow fever in South and Central America, the summaries are accurate and up-to-date for the defined period. In the case of dynamic diseases, however, even a few years bring many changes and it is hoped that supplements will keep the information as current in future years as it is now. These atlases are a must for the military medical library, the medical school, health departments concerned with international travel, and as a source of reference for all others who are concerned with geomedicine.

—*JOHN R. SEAL, Capt., MC, USN*

RHEUMATIC DISEASES, RHEUMATISM AND ARTHRITIS, by *Heinrich G. Brugsch*, M. D., F. A. C. P. 330 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., 1957. Price $10.

This monograph describes the anatomy, physiology, physical examination, diagnostic procedures, and treatment of rheumatic conditions.

A separate chapter is devoted to laboratory procedures, but whether this should be included in such a volume or left to a text on laboratory procedures is debatable.

The author has included a separate chapter on treatment as well as a section on the therapy of each clinical entity presented. To this reviewer, this appears to be reduplication. There is a chapter for each of the commonly classified rheumatic diseases; each of these entities is presented in comprehensive sequence. One does not find psychogenic rheumatism as a clinical entity. The author has included a worthwhile chapter under the heading of "Diseases Simulating Rheumatic Diseases." Side effects of therapeutic agents are discussed and the more common features presented. This chapter might have been expanded further.

References are listed at the end of each chapter. Some of the more recent works, such as Rammelkamp's, on rheumatic fever have been omitted. The text is easily readable, well indexed, and adequately illustrated. Although the format of this volume is a little unusual, it is a worthwhile text and reference book.

—*FRANCIS W. PRUITT, Col., MC, USA*

PRACTICAL CLINICAL PSYCHIATRY, by *Jack R. Ewalt,* M. D.; *Edward A. Strecker,* M. D., Sc. D., LL. D.; and *Franklin G. Ebaugh,* M. D. 8th edition. 457 pages. The Blakiston Division, McGraw-Hill Book Co., Inc., New York, N. Y., 1957. Price $8.

This is the eighth revision of a textbook first published by Strecker and Ebaugh in 1925. The major part of the present revision apparently was done by Dr. Ewalt. It has a new format and is a larger book, bulkwise, than the seventh edition; however, it contains less material and is larger primarily by virtue of the fact that this edition is printed on thicker paper. The book is divided into three sections, including seven chapters on "Basic Concepts," 17 chapters on "Clinical Syndromes," and 13 chapters on "Treatment." Chapter 12, "Mental Deficiency," was written by Malcolm J. Farrell, M. D., and chapter 24, "Child Psychiatry and Mental Health Practices," was written by Warren T. Vaughan, Jr., M. D. The new psychiatric terminology adopted by the American Psychiatric Association and the American Medical Association is used throughout.

For the most part the subject matter presented in the various chapters is of good quality and informative, particularly for the beginner or the medical student. This reviewer, however, objects to the deletion of much of the illustrative clinical material. In the preface the authors stated that because of the increase of clinical material in clinics and teaching facilities, the inclusion of such descriptions in a textbook is no longer necessary. It is the feeling of this reviewer, however, that particularly in psychiatry wherein one deals so frequently with the intangible manifestations of illness and their effect upon the personality, illustrative clinical material is essential to provide information to the general practitioner, medical students, and the be-

ginner in psychiatry to assist in differentiation of the various nuances and clinical manifestations of psychiatric illness.

The sections on "Basic Concepts" and on "Treatment" are particularly good and well worth reading. The clinical syndromes might have been amplified by a more detailed discussion of the character and behavior disorders that appear. This is a group of disorders which all psychiatrists have a tendency to neglect, but about which many questions arise among personnel working with social agencies, the police, child guidance groups, and public institutions. This book has much to offer, but its over-all value is less than that of the previous edition despite the addition of a considerable amount of up-to-date material. It may not sustain its previous popularity in competition with other textbooks of its type.—*ROY E. CLAUSEN, Jr., Lt. Col., MC, USA*

WILLIAM HARVEY, His Life and Times: His Discoveries: His Methods, by *Louis Chauvois.* Foreword by Sir *Zachary Cope.* 271 pages; illustrated. Philosophical Library, Inc., New York, N. Y., 1957. Price $7.50.

It is most fitting and proper that in this year, A. D. 1957, on the tercentenary of the death of William Harvey, we have an opportunity to assay his life and his works. In this compact volume, Doctor Louis Chauvois, The Laureate of the Institute and the Academy of Medicine, (Paris) and an eminent medical historian, has drawn a vivid picture of this great English physician that is unique and refreshing. While drawing deeply upon past and contemporary biographers, he has studied Harvey's immortal classic "De Motu Cordis et Sanguinis," written in Latin and first published in Frankfurt in 1628.

Writing with Gallic enthusiasm, Dr. Chauvois impresses the reader with the obstacles in Harvey's path: centuries of erroneous hypotheses and theories, which he questioned and refuted by years of experiments and observations on the circulation of the blood. Harvey's burning curiosity, his perseverance, his clear thinking, noticeable even during his medical school days at Padua, are brought to light. Dr. Chauvois has well evaluated and utilized his sources of material. His opinions on Harvey's classic discovery are noteworthy, while his own are added on the subject of circulation of the blood. He has given due credit in his modest bibliography, and tells the reader when he assumes a divergent point of view.

This book will stimulate thoroughly the student of medical history into a new appreciation of the momentous impetus which Harvey gave to the advancement of science. Harvey lived into his 80th year. At 72, he allowed to be published "De Generatione Animalium" upon the urging of one of his students, saying at the time: "Nature, however, is the best and most faithful interpreter of her own secrets; and what she presents, either more briefly or more obscurely in one department, that she explains more fully and clearly in another." Harvey was memorialized this past June in the Library of Congress Exhibit of

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the Month which showed a copy of his "Complete Works" published in London in 1766 and a copy of "De Motu . . ." published in Padua in 1643. All physicians should delight in this book. Such an outstanding medical forebear is worthy of our attention and admiration.

—*PAUL V. DAVIS, Col., USAF (MC)*

PRACTICAL OTOLARYNGOLOGY, by *Gervais Ward McAuliffe,* M. D., F. A. C. S., F. I. C. S. 320 pages; illustrated. Landsberger Medical Books, Inc., 1957. Distributed by The Blakiston Division, McGraw-Hill Book Co., New York, N. Y. Price $7.

This is an excellent text for the senior medical student, the general practitioner, and the specialist in aviation medicine. The author has considered the difficulties encountered by the general practitioner and the reasons behind these difficulties. Briefly but adequately he presents applied anatomy and physiology sufficient to permit an understanding of disease when one or both are altered. Of equal importance, the art of medicine is stressed as well as the science, and the practice of conservatism. An excellent section is devoted solely to the physical and functional examination of the ears, nose, and throat, presented superbly because of its clarity and completeness. Most errors in diagnosis are a result of incomplete examination. A clear description of the recognition and treatment of those minor surgical conditions by the physician who first encounters them is presented. These include polypectomy, antral irrigation, foreign body removal, and the immediate treatment of fractured nasal bones. All of the conditions requiring medical or surgical care when first seen are described in detail and in excellent fashion. Thorough study of this text with its easy reading will enable the untrained in otolaryngology to treat many diseases of the ears, nose, and throat.

This text is of immense value to the flight surgeon and should be at hand as a ready reference. The younger flight surgeon engaged in air crew effectiveness finds his greatest difficulty in the recognition and treatment of diseases of the ears, nose, and sinuses sometimes resulting in serious sequelae. A thorough acquaintance with this text will greatly enhance the therapy of the sick flyer and preclude the serious sequelae and a high noneffective rate.

—*FRANK A. PERRI, Col., USAF (MC)*

CLINICAL ORTHOPAEDICS, No. 8, Chronic Hereditary Diseases and Developmental Anomalies. *Anthony F. DePalma,* Editor-in-Chief. 337 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., 1957. Price $7.50.

There is much thought-provoking and valuable material in this volume of *Clinical Orthopaedics.* The first section is devoted to chronic hereditary diseases and developmental anomalies with articles by 15 authors from this country and abroad, orthopedists, anatomists, and geneticists. Of particular practical interest is an article by Denis Browne on splinting.

The second section, entitled "General Orthopaedics," contains 11 articles. An excellent one on hemophilic arthropathy is based on an

analysis of 117 hemophilic families and includes a discussion of the correction of resulting joint deformities. Another presents the scapulocostal syndrome as a little-known entity. There are two readable discussions of the public relations aspects of a physician's life, financial and medicolegal. The other papers in this section are on various clinical subjects.

The third section on motorist injuries is Part II of the symposium begun in the preceding *Clinical Orthopaedics, Number 7*. This installment deals with automobile crash injury research on reduction of injuries. The medical profession, which has long considered the automobile accident as a therapeutic problem, is rapidly coming to think of it in terms of preventive medicine, and to apply medical knowledge to all causative factors, even automobile designing. To quote Doctor McElvenny from another section of this volume, "The motor car manufactures need top medical thinking. We need cars designed to preserve life and limb."—*MILTON S. THOMPSON, Col., MC, USA*

THE TREATMENT OF WOUND SHOCK, The Wound Shock Working Party, Medical Research Council Memorandum No. 34. 39 pages. Published by Her Majesty's Stationery Office, London, England, 1957. Price 3s. 6d. net.

This small, paper-backed manual of 39 pages, written by the Medical Research Council and the working party for revision of Medical Research Council War Memorandum Number 1 from the privy council of Her Majesty's government of London, England, is divided into two parts. The first part discusses the nature and assessment of wound shock, while the second part concerns treatment which includes general and specific methods. An excellent descriptive text of assessment of blood loss and shock, including different types of shock, are brought out in such a fashion that this manual becomes of great value, especially for younger doctors and medical students, and as an excellent review for more experienced, practicing physicians and surgeons. The abuse and use of blood and plasma expanders is rationally presented and the underlying physiology is explained.

In part two, which deals with treatment, general and specific measures are adequately presented and specific details are brought out on choice of fluid, amount of blood, rate of transfusion, and lack of response to transfusion. A discussion on the type of anesthesia utilized and a fine discussion on postoperative care are presented. Some modifications of treatment on special types of injuries and the metabolic consequences of injuries are noted. A discussion of fat embolism and anuria due to crush syndrome and other severe injuries is very adequately explained and specific therapy is indicated. There is an excellent rapid treatise on burns and, in the appendixes, a useful section on the use of plasma substitutes. The paper concludes with an appendix on untoward reactions following transfusions and the therapy thereof. In general this is an excellent manual for quick and ready reference for the treatment of traumatic injuries either due to blunt

trauma, missile trauma, or burns. It is highly recommended for medical students, interns, and residents, and as a very rapid, excellent reference for all practicing physicians and surgeons.

—*VICTOR C. STRATTON, Capt., MC, USN*

PRACTICAL OFFICE GYNECOLOGY, by *Albert Decker,* M. D., D. O. G., F. A. C. S., and *Wayne H. Decker,* M. D., D. O. G. A Series of Monographs, Obstetrics & Gynecology, edited by *Claude E. Heaton,* M. D. 388 pages; 103 illustrations, 19 in color. F. A. Davis Co., Philadelphia, Pa., 1956. Price $10.50.

This is a practical, concise, well-illustrated, 347-page manual dealing with all phases of office diagnosis and management of gynecologic problems. Factors especially stressed are simplicity, effectiveness, and safety. The first section deals with history taking, physical examination, and special office procedures. Certain subjects are of necessity covered only in a cursory manner, notably the section on hysterosalpingography. The diagnosis and management of specific disease entities are adequately reviewed. This section offers a succinct review of most of the gynecologic problems confronting the practitioner in his office. The diagnostic and treatment procedures generally are standard ones. The currently acceptable principles of hormone therapy are discussed in an excellent chapter, which includes a complete table of commercial preparations. The importance of early cancer detection is repeatedly stressed throughout the book, and one entire chapter is devoted to the diagnostic aids to this end. There is a complete and extensive bibliography. The volume admirably fulfills its purpose in serving primarily as a useful manual for the student and as a succinct refresher course for the practitioner. The presentation is not, nor is it intended to be, on a level comparable with a classical standard gynecologic text.—*HUMBERT L. RIVA, Col., MC, USA*

DISEASES OF THE NOSE, THROAT AND EAR, by *Howard Charles Ballenger,* M. D., F. A. C. S., and *John Jacob Ballenger,* B. S., M. S., M. D. 10th edition. 968 pages; 550 illustrations and 11 plates in color. Lea & Febiger, Philadelphia, Pa., 1957. Price $17.50.

This new edition has been brought up to date, and many surgical technics such as rhinoplasty and submucous resection are described in detail. The section on respiratory physiology is brief but excellent. In the one on sinusitis, there is a complete description of the various operations upon the sinuses. The section on the larynx includes Morrison's recent work on the anatomy of the recurrent laryngeal nerve and reconstructive procedures for vocal cord paralysis. The description for the procedure of tracheotomy is adequate but there are too few illustrations.

There is an excellent section on defects of speech which is a worthwhile addition to a book of this type. The physician should have an understanding of speech defects and know when to refer patients with speech disorders for speech therapy. The section on physiology of

hearing is current, concise, and clearly understandable. The last chapter on bronchoesophagology, by Jackson, is a worthwhile adjunct.

Throughout this edition, there is a notable lack of description of the simple but commonly performed procedures, such as the treatment of nasal fractures and infraction of the middle turbinate. The section on acute diffuse otitis externa, the most common disorder of the external auditory meatus, is incomplete. Bacteriologic studies done during World War II by Senturia, which show that the etiology of external otitis is rarely due to fungi, are not reported. Current methods of treatment of this common condition are not recorded. Despite its shortcoming, this is an excellent book for residents and specialists in otolaryngology. The lack of adequate description of simple procedures and treatment of the common disorders of the ears, nose, and throat limit its use for the general practitioner.

—RALPH N. KRAUS, Lt. Col., USAF (MC)

ANESTHESIOLOGY AND RELATED PROBLEMS. Conference Co-Chairmen: *C. R. Stephen* and *E. J. deBeer.* 180 pages; illustrated. ANNALS OF THE NEW YORK ACADEMY OF SCIENCES, Volume 66, Art. 4, pages 841-1022, April 2, 1957. Editor-in-Chief, Otto V. St. Whitelock; Managing Editor, Franklin N. Furness. The New York Academy of Sciences, New York, N. Y., 1957. Price $4.

The volume is published in the general format of a professional journal, and is divided into four major parts consisting of 16 separate articles by 24 authors.

The first part discusses geriatric anesthesia. Nutritional and hematologic factors like anemia and hypoproteinemia may be concealed and unrecognized unless specific laboratory procedures are performed. It is emphasized that hasty surgery must be avoided in the presence of uncorrected nutritional deficiencies. Cardiovascular complications are treated from the standpoint of reflex, chemical and metabolic depression of cardiac function, changes in peripheral vascular resistance, interference with venous return to the heart, acute cardiac failure, and coronary disease. Mechanical problems in the use of mechanical respirators on patients with high airway resistance and low pulmonary compliance are outlined. The choice of anesthetic drugs and methods must depend on an evaluation of the metabolic functions of each individual patient.

Part two reviews controlled respiration in anesthesia, beginning with a review of respiratory physiology and a comparison of artificial respiration with natural respiration. Effects of pressure breathing on systemic and pulmonary circulation are shown, and it is concluded that a normal individual will well tolerate controlled respiration applied by any reasonable method. The methodology of controlled respiration is approached from the aspects of pharmacologic, mechanical, and combined methods, and a warning of the dangers in the methods. The evolution of controlled respiration in anesthetic practice is traced

and the author finds it inevitable and desirable that clinical application of controlled respiration will increase.

The section on fluid and electrolyte balance in surgery begins with a discussion on the diagnosis and treatment of respiratory alkalosis. The article on fluid and electrolyte therapy in pediatric surgery contains useful tables on surface area and fluid requirements. The contribution of radioactive isotopes to the study of electrolyte balance in surgery is briefly evaluated.

The final part surveys hypotension in the operating room. The effects of some anesthetic agents on blood pressure, cardiac output, and peripheral resistance are noted. The problem of adrenocortical insufficiency during surgical anesthesia is presented. The role of the autonomic nervous system in causing circulatory reflexes resulting in hypotension is reviewed and schematically charted. The hemodynamic effects of sympathomimetic amines are charted. Protective mechanisms in shock on laboratory animals are presented.

This review of problem areas encountered by surgeons and anesthesiologists will be of value to the practitioner in his daily work and to the teacher as a discussion of four current teaching problems.

—ROBERT E. LAU, Lt. Col., USAF (MC)

The Principles and Methods of PHYSICAL DIAGNOSIS, Correlation of Physical Signs with Certain Physiological and Pathological Changes in Disease, by *Simon S. Leopold,* M. D., with a Chapter on Sounds from the Thorax: Acoustic Principles, by *S. Reid Warren, Jr.,* Sc. D. in E. E. 2d edition. 537 pages; 379 illustrations and 25 color plates. W. B. Saunders Co., Philadelphia, Pa., 1957. Price $9.

The second edition of this textbook on physical diagnosis presents a completely revised and improved presentation of a book which in its first edition gained wide acceptance as a standard in this field.

This edition has been expanded from 430 to 537 pages. A chapter on the pediatric examination has been added to make the book of more general value. Another on medical history has been amplified and strengthened, and the one on psychiatric survey has been revised by including some of the recent psychiatric concepts of human behavior. Charts and drawings have been added to discussion of the neurologic examination to demonstrate the more common neurologic lesions and indicate the proper technic in such an examination. A number of electrocardiograms and phonocardiograms have been included which record, better than words can relate, the ausculatory signs of numerous cardiac abnormalities.

The number of colored illustrations have been increased and new photographs have been generously inserted throughout the book. As a result the text is even better illustrated than was the first edition. This book is recommended to the student as a standard textbook in the field of physical diagnosis. *—GEORGE M. POWELL, Col., MC, USA*

CIBA FOUNDATION COLLOQUIA ON ENDOCRINOLOGY, Volume 10, Regulation and Mode of Action of Thyroid Hormones. Editors for the Ciba Foundation: *G. E. W. Wolstenholme,* O. B. E., M. A., M. B., B. Ch., and *Elaine C. P. Millar,* A. H.-W. C., A. R. I. C. 311 pages; 114 illustrations. Little, Brown & Co., Boston, Mass., 1957. Price $8.50.

This book is the latest addition to the Ciba Foundation's *Colloquia on Endocrinology.* The field of thyroid physiology and pharmacology has become infinitely broader with the advent of more adequate tools for investigation. This book is an important contribution in presenting the latest concepts of thyroid physiology and pharmacology, and in the discussion of these concepts the participants in this symposium are among the world's outstanding authorities on the subject. A definite attribute of the book is the excellent discussion at the conclusion of each paper.

Papers are presented concerning the nature of the thyroid hormone, possible conversion to more active principals, mechanism of action, interrelationship with other endocrine gland products, and the mechanism of control of thyroid output. The technics of experiment used in gaining these data are described, and differing points of view aired in the discussion of each paper. Clinical applications are alluded to wherever possible.

The book is most useful to those interested in research endocrinology and to those interested in thyroid physiology and pharmacology. The general internist will find it useful for reference.

—*WILLIAM R. SCHILLHAMMER, Maj., MC, USA*

Rypins' MEDICAL LICENSURE EXAMINATIONS, Topical Summaries and Questions, edited by *Walter L. Bierring,* M. D., M. A. C. P., M. R. C. P. Edin. (Hon.) with the collaboration of a review panel. 8th edition. 964 pages. J. B. Lippincott Co., Philadelphia, Pa., 1957. Price $10.

This is the eighth edition of this compendium of medical examination questions which, in itself, is a tribute to its value and practicality. The book is divided into sections on the basic sciences and the various branches of medicine and surgery. Each section is compiled by a capable authority, who has written a summary of the salient facts in his field that covers briefly but in a logical and organized way the information usually asked by state licensing boards over the years as well as new developments which might be included. This plan seems much sounder pedagogically than a long series of questions and answers. There are questions aplenty for which the answers can be found in the epitome preceding.

Perhaps one of the most worthwhile and useful chapters gives examples of questions given. Particularly since the advent of multiple-choice, mechanically graded questions, the understanding of a new question format seen for the first time by a candidate in the throes of examination is often a stumbling block. Familiarity with multiple choice of facts, associated and related item lists, questions whose answers depend on previous answers, quantitative values and comparisons,

cause and effect types, and series of questions based on case histories is a great help before the examination room is entered.

This book is excellent for its purpose and should aid the student or graduate. It is a good review for anyone.

—*JAMES L. TOBIN, Col., USAF (MC)*

The Clinical Management of VARICOSE VEINS, by *David Woolfolk Barrow*, M. D., with a Foreword by *Arthur W. Allen*, M. D. 2d edition, revised and enlarged. 169 pages; illustrated. Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, New York, N. Y., 1957. Price $6.

This well-written and well-illustrated small volume presents for the general practitioner and for the surgical resident most of the basic information needed relative to the diagnosis and treatment of varicose veins. The pen-and-ink drawings make the text easy to follow. The fact that so many of our patients in the older age group present peripheral vascular problems with increasing frequency makes this monograph a welcome addition to the physician's library.

—*PHILIP J. McNAMARA, Capt., MC, USN*

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES, Volume 64, Art. 5, pages 735-1073, March 22, 1957. Editor-in-Chief, *Otto V. St. Whitelock;* Associate Editor, *Franklin N. Furness.* "SECOND TISSUE HOMOTRANSPLANTATION CONFERENCE." Conference Chairmen: *John Marquis Converse* and *Blair O. Rogers.* 338 pages; illustrated. The New York Academy of Sciences, New York, N. Y., 1957. Price $4.50.

This volume deals with many facets of the homograft problem, but places special emphasis on alteration of the normal host-graft relationships. While the ultimate objective of the permanent survival of the homograft in the human still remains an elusive goal shrouded by the mysterious and incompletely understood sequence of events known as "rejection," nevertheless this volume contributes to further progress in this field. This is done in several ways: (1) Ingenious technical methods are described which have and will further facilitate investigation; (2) experimental data presented shed further light on the problem; (3) clinical application of some investigative results are pointed out; (4) avenues for further investigative work are opened up.

The many papers dealing with induction of tolerance, not only in the embryo but also in the adult animal, lead one to hope that this may eventually be applicable to the human. The fact that skin homografts in the human survive longer if taken from individuals closely related to the recipient and whose blood groups are the same, is of importance to the clinician. The demonstration that bone marrow transplants in animals survive permanently in irradiated recipients, holds great possibilities for victims of this atomic age, if and when this technic is made possible in the human. This volume is recommended to all those interested in the homograft problem.

—*JOSEPH R. CONNELLY, Capt., MC, USN*

PRACTICAL GYNECOLOGY, by *Walter J. Reich,* M. D., F. A. C. S., F. I. C. S., and *Mitchell J. Nechtow,* M. D., F. A. C. S., F. I. C. S. 2d edition. 648 pages; 284 illustrations including 68 subjects in color. J. B. Lippincott Co., Philadelphia, Pa., 1957. Price $12.50.

With special emphasis on office gynecology rather than upon highly specialized hospital procedures, this book admirably fulfills the needs of the general practitioner for whom it was principally designed. The subject material is presented in an unusually clear and concise manner. The "to the point" differential diagnosis of gynecologic symptoms and signs is refreshingly clear. While presenting an authoritative description of elementary and time-tested methods, procedures, and treatments, full consideration is given to the newer concepts and current practices of gynecology. Each chapter is complete in its coverage of the basic subject material albeit repetitious insofar as the entire text is concerned. Placing the diagnosis and treatment of female disorders within the framework of medicine as a whole further adds to its usefulness by the general practitioner as well as the student or would-be specialist.

Nine entirely new chapters have been added to this expanded second edition. There also is a new section on the diagnosis of early pregnancy, and considerable material has been incorporated in the chapter on examination of the breast. Although the chapter devoted to radiation therapy is presented in a most lucid manner, one cannot help wondering whether the authors have not overreached their goal by adding this discourse to a book devoted primarily to office type gynecologic practice. The reviewer would concede that this chapter is of extreme interest but doubts that the sketchy outline would be of any great value to a general practitioner. Current literature findings do not support the authors in their recommendation of therapeutic abortion in a patient who had previously been treated for carcinoma of the breast three years before by radical mastectomy. Eastman, Westberg, Thomas Taylor White, and the writings of others would indicate that the authors' opinion is on tenuous ground at the present time. Again, full discussion of such an important subject would be best omitted from this otherwise fine publication leaving this matter to more comprehensive major works. With the exception of these minor criticisms, this book is recommended as an authoritative reference source in the field of practical gynecology for use by the general practitioner, intern, and medical student.—*EDWARD A. ZIMMERMANN, Col., MC, USA*

DeLee's OBSTETRICS FOR NURSES, by *M. Edward Davis,* M. D., and *Catherine E. Sheckler,* R. N., M. A., with a Foreword by *Ann Kirchner.* 16th edition. 625 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1957. Price $4.75.

It is gratifying to note that the social and psychologic aspects of pregnancy have been pointed up, and special emphasis placed on pregnancy as a normal physiologic function. This new approach clearly demonstrates the increasingly important role the nurse is being called

upon to play, and makes us realize that she must become better prepared to meet this new challenge.

The hospital corpsmen who have read this text without any urging were very favorably impressed. They found it extremely interesting and easy to understand. A new interest in obstetrics seems to have been stimulated, which will be encouraged since we have such a marked shortage of trained, interested, and properly motivated personnel to staff our obstetric units.

The illustrations are excellent throughout the book.

The inclusion of the father in the total picture, with parent's classes, and the section on natural childbirth and rooming-in emphasize again that this is a normal physiologic function, not an illness, and therefore is a family affair.

This book, which was written primarily for student nurses, is also highly recommended as a reference book for all graduate nurses, especially those in the advanced clinical programs.

—CATHERINE J. CRANE, Lt., NC, USN
MARCUS A. GODINEZ, Capt., MC, USN

OBSTETRICAL NURSING, by *Carolyn Conant Van Blarcom,* R. N. Revised by *Erna Ziegel,* R. N., B. S. 4th edition. 855 pages; illustrated. The Macmillan Co., New York, N. Y., 1957. Price $6.50.

This new edition succeeds in meeting its objective, "to present in a modern and comprehensive form the many recent advances in obstetrics and obstetric nursing." The format is excellent, the illustrations are clear and accurate, and the historical data well placed for easy reading. The book is well indexed, has an excellent glossary, and a good bibliography at the end of each chapter. The first half is devoted to anatomy, physiology, the development of the baby, and birth. The chapters which follow are "The Nurse's Duties during Labor" and "Analgesia and Anesthesia." These are both approached in an up-to-the-minute manner. New drugs and types of anesthesia are carefully considered and the author has given space in pointing out advantages and disadvantages of each. One chapter is devoted to "Recent Trends in Maternity Care" and though brief, it covers such programs as the emergency maternity and infant care program, the World Health Organization, midwifery, and the development of complete maternity care. Part VII, which presents "The Care of the Baby," is excellent. It explains in detail the normal and the premature as well as describing the latest methods in care and feeding.

This excellent textbook has been revised and almost completely rewritten; hence it becomes one of the most up-to-date books for nurses during their clinical experience in obstetrics. The data presented is given in an understanding manner and should make learning an easy matter. It contains a wealth of new material and should be a valuable reference. It is recommended for the libraries of all schools of nursing.—*JOSEPHINE M. GREEN, Maj., ANC, USA*

MENTAL DEPRESSIONS AND THEIR TREATMENT, by *Samuel Henry Kraines*, M. D. 555 pages; illustrated. The Macmillan Co., New York, N. Y., 1957. Price $8.

As far back as the records of man go, "mental depressions" have plagued the human race. Many explanations have been offered and numerous treatments suggested. When Saul, the first King of Israel, became depressed, the following explanation was given: "Now the Spirit of the Lord departed from Saul and an evil spirit from the Lord tormented him." The therapy was a form of recreation . . . "And whenever the evil spitit from God was upon Saul, David took the lyre and played it with his hand and Saul was refreshed and was well and the evil spirit departed from him." However, recreation as a therapy has not always been so effective. Still later the humoral theory of excessive black bile was offered and remained a popular one for centuries.

During the past 50 years the psychodynamic theory has been the most popular, and the psychoanalytical school of psychiatry the most articulate. It is refreshing to receive a book challenging the predominant concepts. However, one gets the impression from Dr. Kraines' concept that the manic-depressive depression is a result of disturbed physiologic function in the diencephalic area, including the thalamus, the hypothalamus, the reticular system and the rhinencephalon is possibly overstressed; that its frequent repetition does not necessarily make it true. Modern psychiatric literature certainly suggests that there is a need to call attention to the possibility that psychiatry is losing the somatopsychic approach to illness of the psyche, and this book emphasizes that approach in a very interesting, comprehensive, and effective manner.

The chapters on symptoms and diagnoses are most instructive. During the past five years, spent largely at Air Force training bases, this reviewer has often felt uneasiness when schizophrenia and reactive depression were such frequent diagnoses and very seldom challenged. Dr. Kraines has made one aware of the possibility that manic-depressive illness is still with us and has emphasized the need for considering differential diagnoses. His type of therapy seems particularly practical and should be useful in the military setting.

This book is recommended for military hospital libraries, and can be read with profit by the general medical officer as well as the specialist.—*CHARLES H. WIGGINS, Lt. Col., USAF (MC)*

LOCAL ANESTHESIA AND PAIN CONTROL IN DENTAL PRACTICE, by *Leonard M. Monheim*, B. S., M. S., D. D. S. 299 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., 1957. Price $8.75.

This unique volume implements the author's belief that dental surgical procedures can and should be done with a complete absence of pain. It contains a wealth of information concerning not only local anesthesia and pain control but also such related subjects as sterilization procedures, office emergencies, a welcome extensive illustrated

review of trigeminal nerve anatomy and function, and a chapter on the medicolegal aspects of office procedures.

The various technics of block, field, and infiltration are described clearly and concisely. The chemical, pharmacologic, and physiologic properties of each are so outlined as to permit considerable latitude in the choice of agents. Perhaps too much attention is given to the extraoral technics of local anesthesia which apparently are but seldom used in dentistry. The author discusses the physiology of pain and its control, indicating that postoperative pain is also the responsibility of the dentist. It is also his belief that painless procedures depend in great part on the patient's co-operation as influenced, to a degree, by his pain threshhold. Of interest to anesthesiologists is the stress placed on preanesthetic medication for dental anesthesia. Considerable space is allocated to the advantages and disadvantages of various drugs. This is a field that, it would seem, many dentists overlook entirely. The chapter on complications and emergencies is excellent as a reference for the practicing dentist and for the student who has advanced enough to understand the terminology employed.

—ROBERT F. CORWIN, Col., USAF (MC)

Management of the Patient with HEADACHE, by *Perry S. MacNeal,* M. D., F. A. C. P.; *Bernard J. Alpers,* M. D., Sc. D. (Med.), F. A. C. P.; and *William R. O'Brien,* M. D., F. A. P. A. 145 pages. Lea & Febiger, Philadelphia, Pa., 1957. Price $3.50.

This book is a rather brief survey of the problem of headache, but no important aspects of the subject have been omitted. A great deal of general and specific information may be gleaned from its 138 pages.

The first three chapters are devoted to mechanisms of head pain of organic, psychologic, and vascular origin, respectively. The discussion of psychologic mechanisms did not strike this reviewer as being very rewarding, probably because of the inherent difficulties in presenting such material in abbreviated and simplified terms.

The major portion of the book is devoted to differential diagnosis and treatment of the various types of headache. The grouping is more or less arbitrary and a certain amount overlapping results, but this does not detract from the effectiveness of the presentation. Migraine is dealt with at considerable length, and the discussion is an excellent one. In regard to the so-called "histamine cephalalgia" of Horton, the authors express the opinion that food allergy is the cause and that it can be successfully managed by the use of elimination diets. They acknowledge quite clearly, however, the difficulties involved in successful treatment along these lines.

An important asset of the book is its readability. It is written (for the most part) in a conversational style and is sufficiently lighthearted at times to make this troublesome and rather fatiguing subject of headache a little easier to contemplate.

—HARVEY E. REITZ, Capt., MC, USN

MODERN THERAPY IN NEUROLOGY, edited by *Francis M. Forster*, M. D., with foreword by *H. Houston Merritt*, M. D. 792 pages. The C. V. Mosby Co., St. Louis, Mo., 1957. Price $12.

It is entirely appropriate that the first American work dedicated to the treatment of neurologic illnesses should be compiled and edited by Dr. Francis M. Forster, Dean and Professor of Neurology of the Georgetown University Medical School, Washington, D. C. There are few neurologists who have contributed more than Dr. Forster to the establishment of neurology as a therapeutic as well as a diagnostic specialty. This book is a comprehensive and up-to-date survey of the current status of treatment in all major neurologic disorders, and consists of 18 chapters. These chapters cover infectious diseases of the central nervous system, including neurosyphilis, cerebral vascular disease, headache, epilepsy, myasthenia gravis and other neurologic muscular conditions, basal ganglion diseases, toxic and metabolic disorders, peripheral nerve disorders, degenerative and developmental diseases, cerebral neoplasm, nervous system trauma, and a chapter each on rehabilitation of the neurologic patient and use of tranquilizing drugs in neurology. All of the sections are excellent and some are truly outstanding in their elucidation of treatment in neurology.

The general contents are remarkably up to date, particularly considering the length of time usually necessary to compile a book of this nature. The contents of the book seem to be directed to a great extent toward the general practitioner and toward the internist who might have occasion to treat neurologic patients. In the treatment sections dealing with pharmacologic compounds most of the drugs are described in detail, including the preparations and forms in which they are available, their color, and their trade name. Although directed primarily, it would seem, toward the practitioner of medicine other than neurology, there is much material in the book that the specialist will find valuable as dosage programs and treatment programs are, in most instances, outlined in considerable detail, and a neurologist will find this book of considerable value in reviewing treatment methods in the less common conditions with which he may have to deal. The book is largely devoted to therapy though each section contains a concise outline of the salient features of the disease entity with which the treatment has to deal. Very little space is devoted to this, however, as the authors rightly assume that a more completely descriptive outline of the various disorders can be obtained from other reference books. Of considerable aid to the practitioner, or to the specialist, is the very excellent bibliography which appears following each chapter. The references concerning treatment in the various disorders are numerous and exhaustive.

In summary, it is the feeling of this reviewer that this book successfully accomplishes the task of outlining modern neurologic treatment as it is practiced today in this country, and is a valuable addition as a reference book in therapy to the library of the general practitioner and the internist or specialist in diseases of the nervous system.

—ROY E. CLAUSEN, Jr., Lt. Col., MC, USA

New Books Received

Books received by the *U. S. Armed Forces Medical Journal* are acknowledged in this department. Those of greatest interest will be reviewed in a later issue.

NEW RESEARCH TECHNIQUES OF NEUROANATOMY, A Symposium Sponsored by the *National Multiple Sclerosis Society,* edited by *William F. Windle,* Ph. D., Sc. D. Foreword by *Frederick L. Stone,* Ph. D. 98 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1957. Price $4.75.

PEDIATRIC CLINICS OF NORTH AMERICA, August 1957, Symposium on Handicaps and Their Prevention. *Carl C. Fisher,* M. D., Consulting Editor. 799 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1957. Price $15 per year of four books issued quarterly. Sold only by a year of four consecutive numbers.

CURRENT SURGICAL MANAGEMENT, A Book of Alternative Viewpoints on Controversial Surgical Problems. Editors: *John H. Mulholland,* M. D.; *Edwin H. Ellison,* M. D.; *Stanley R. Friesen,* M. D.; with contributions by 76 American authorities. 494 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1957. Price $10.

ONE SURGEON'S PRACTICE, by *Frederick Christopher,* M. D. 151 pages. W. B. Saunders Co., Philadelphia, Pa., 1957. Price $4.50.

PROGRESS IN GYNECOLOGY, Volume III, edited by *Joe V. Meigs,* M. D., and *Somers H. Sturgis,* M. D. 780 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., 1957. Price $15.50.

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